MARCH 1984 ANNUAL BOARD MEETING

Report of the Ad Hoc Committee on Amateur Radio Digital Communication Doc. #32

March 1984

Minute 56 of the October 1983 Board Meeting directed the Committee to "draft procedures and practices covering the establishment, operation and use of computer-based message systems, including recommendations suggesting those frequencies which are appropriate and/or desirable for such operation, the draft to be presented at the March 1984 Board Meeting." The draft is included as an annex to this report.

The Committee met on November 11 and 13 in the Washington, DC area. At that meeting, the Committee considered the Minute 56 CBMS question and recommended that the Board consider petitioning the FCC to permit automatic operation for digital communications. Also, the Committee completed work on the AX.25 link-layer (level-2) packet-radio protocol definition except for one small detail -- the poll/final (P/F) bit -- which was unresolved. A report dated November 15, 1983 was mailed to the Board.

Since the November Committee meeting, the drafting of the AX.25 level-2 protocol definition has been completed by Terry Fox, WB4JFI. Present plans are to submit this "standard" to the Board at the fall meeting.

At the November Committee meeting, the West Coast members reported on the establishment of WESTNET, the chaining of existing packet-radio repeaters from San Francisco to San Diego. Since then, a parallel effort on the East Coast, called EASTNET, is developing to connect packet repeaters from Boston down to Washington, DC, including a packet repeater activated at ARRL Hq. Both WESTNET and EASTNET are expected to be fully connected sometime during 1984.

The next meeting of the Digital Committee will be on April 14 at Trenton, NJ. The Third ARRL Amateur Radio Computer Networking Conference will be held the following day. All the technical papers to be presented have been received in camera-ready form for printing of proceedings prior to the conference.

Respectfully submitted,

Paul L. Rinaldo, W4RI
Chairman

ANNEX

DRAFT RECOMMENDATIONS FOR AMATEUR RADIO COMPUTER-BASED MESSAGE SYSTEMS

INTRODUCTION

These are recommended procedures and practices for the establishment, operation and use of Amateur Radio computer-based message systems (CBMSs). These systems are also know by various names, including Message Storage Operation (MSO) (a trade name of HAL Communications Corp.), bulletin board, and mailbox.

BACKGROUND

As soon as microcomputers were available at a reasonable cost in the mid 70s, experimenters built CBMSs and made them accessible via phone lines and Amateur Radio. Possibly the first, Tom Aschenbrenner, WB5PUC, activated his system on 2 meters on October 1, 1975, when RTTY operation was limited to Baudot.

Today, there is no accurate count, but Amateur Radio CBMSs number well over 100 and have spread worldwide. Many of these systems operate on 2 meters and serve local Baudot RTTY or packet-radio users. Other systems operate on the HF bands, predominantly using Baudot on 20 and 40 meters.

The Amateur Radio CBMS provides an important service to radio amateurs. It frees the addressees from having to be there when someone else is transmitting a message for them. The CBMS also has great potential for third-party traffic handling, particularly for emergency communications. Furthermore, they not only represent an information resource for radio amateurs, but are a definite drawing card for new and sustained interest in advanced digital communications technology. CBMSs can provide amateurs with up-to-date information on propagation, DX, events, QSL addresses, and other data of widespread interest to amateurs.

On the other side, the automation involved in a CBMS invites potential abuses. The CBMS's ability to store and forward messages (without human intervention) makes it possible for the CBMS to automatically retransmit messages of types that are prohibited by the rules (for example, business or indecent language). Like any other radio user, a CBMS takes up valuable spectrum space and can be in contention with others wishing to use the same frequency. As the CBMS is regarded as the newcomer, the more traditional user may object to the added competition. On 2 meters, frequency disputes have been resolved through the frequency-coordination mechanisms already in place. On the HF bands, there is no widely recognized frequency-coordination system and no channelization within the bands. This is further complicated

by the fact that the geographical area where the CBMS is heard can cover half the globe and varies according to time, season and sunspot activity. Nevertheless, the HF CBMS operators generally have been very sensitive to the need to conserve spectrum in the HF RTTY bands and have time-shared several frequencies.

Another problem related to the slower (for example 60-WPM Baudot) CBMSs is that it takes about 10 minutes to send a full page of text. Further, conventional Baudot transmission has a 100% duty cycle, which does not offer an opportunity to break in until the sending station has completed a transmission. Thus, if you request transmission of a page of text, you can't turn it off and must wait until it is finished. This can be reduced by keeping CBMS responses as short as possible and frequently turning the circuit around for a go-ahead on longer files. For AMTOR low speed is still a problem, but automatic-repeat-request (ARQ) operation can offer an opportunity to terminate undesired transmissions. Packet-radio operation not only includes break-in (by virtue of its ARQ mode) but normally operates at higher speeds (300 to 1200 bauds -- 5 to 20 times that of 60-WPM Baudot) and automatically time shares a channel with other users. Packet-radio systems listen before sending and are inhibited from transmitting until the channel becomes free.

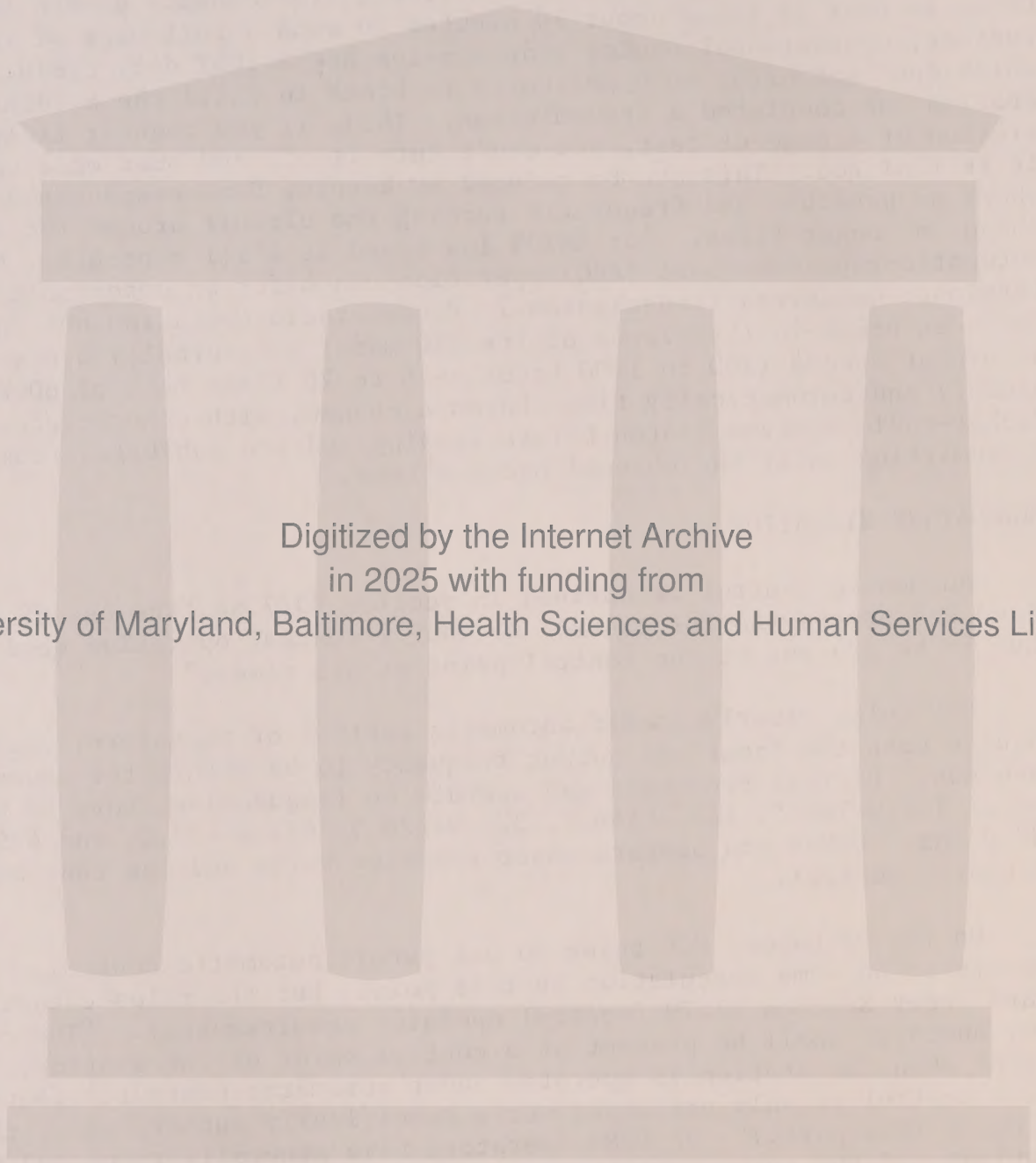
REGULATORY SITUATION

Automatic control is defined in section 93.7 as "the use of devices and procedures for control so that a control operation does not have to be present at the control point at all times."

FCC rules clearly permit automatic control of repeaters, which require both the input and output frequency to be within the repeater subbands. Digital repeaters may operate on frequencies above 52 MHz except 144.0-144.5, 145.5-146.0, 220.0-220.5, 431.0-433.0, and 435.0-438.0 MHz. CBMSs can operate under repeater rules and can thus use automatic control.

On the HF bands, FCC rules do not permit automatic control. There appears to be some speculation on this point, but the rules clearly state under Section 97.79 (control operator requirements): "The control operator shall be present at a control point of the station, except when the station is operated under automatic control. (Automatic control is only permitted where specifically authorized by the rules of this part.)" HF CBMS operators have generally respected this provision of the rules except for a few lapses where automatic control has failed and the operator did not exercise control.

Operator control includes two aspects: (1) the ability to detect malfunctions and terminate transmission, and (2) the ability to detect improper traffic and prevent, or stop, its retransmission. These



functions can be fulfilled by the operator's physical presence at the CBMS and by watching the screen as well as monitoring the transmitter output. Some CBMS operators are able to watch their systems while on the air, either by being at home all day or by simply turning the system off when they leave.

It may be appropriate to ask the FCC to permit automatic operation of digital communications stations in the HF bands with certain safeguards such as those described in this paper. This belief is based on (a) the responsible record of Amateur Radio CBMS operators to date, and (b) the technical safeguards made possible through automation.

INTERIM RECOMMENDATIONS

ESTABLISHMENT OF NEW SYSTEMS

- New CBMSs should serve a need within the basis and purpose of Amateur Radio as stated in section 97.1 of the FCC rules and not simply add to congestion by duplicating services already available.

- Frequencies should be selected in accordance with the ARRL band plans.

- VHF and UHF channels should be coordinated with the appropriate frequency coordinator(s).

- Frequencies in the HF bands should be time-shared with existing CBMSs to the extent possible in coordination with the other CBMS operators using that same frequency.

- Where sharing of an existing frequency is not feasible, new channels should be selected near the upper portion of the particular RTTY subband, leaving the lower parts of the RTTY subband to DX and other operator-to-operator QSOs.

OPERATIONAL SAFEGUARDS

- CBMSs should listen before transmitting. The system should sense activity on the channel and not transmit until the channel goes free. This can be accomplished by a carrier-detect circuit.

- Incoming messages should not be retransmitted until read and released by the CBMS operator.

- Until such time that the FCC permits unattended automatic operation of HF CBMSs, CBMS operators should monitor their

transmissions (at least aurally) at all times that the CBMS is on the air and have a reliable method of terminating transmission in the event of malfunction. Monitoring may be done from a remote location.

- The system should have software provisions to limit specific responses to a maximum of 10 minutes. Longer responses should be interrupted at least every 10 minutes for a go-ahead from the other station.

- The system should have a hardware "watchdog" timer to limit individual transmissions to 10 minutes.

- In order to make the channel available to other stations, CBMS operators should cull files that are out of date and offer user instructions for an s.a.s.e. by mail.

- A CBMS operator should establish and make public a policy regarding acceptance of borderline traffic such as that relating to sale of equipment after reviewing current FCC rules and interpretations. (See appendix for a copy of an FCC letter).

USER OPERATING PRACTICES

- Monitor the frequency for a short period before calling a CBMS.

- Do not interrupt another station using a CBMS.

- Do not interfere with a QSO on or near the frequency.

- Always properly identify your station.

- Keep your signals on frequency.

- Do not list "for sale" items without prior permission of the CBMS operator.

- Make sure that you deactivate the CBMS by using that system's correct EXIT command.

(Note: The above user operating practice suggestions were adopted from KØVKH "MSO Golden Rules.")

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

June 10, 1974

IN REPLY REFER TO:
7527

[redacted]

This is in response to your recent letter to the Commission.

We have reviewed Section 97.112 of the current rules with respect to the use of an amateur station for material compensation, either directly or indirectly. We have concluded that a licensed amateur can use his station from time to time to discuss the availability and price of a piece of his amateur radio equipment, but such activity would be limited to that of an occasional nature, and could not include any items of a personal nature such as a camera, ordinary radios, etc., nor could this activity be conducted on a regularly scheduled basis.

Therefore, if such discussions, as specified in your letter, meet the above criteria, they are in accordance with the FCC Regulations.

If you have any further questions, please contact us.

Sincerely yours,

A. Prose Walker

Charles A. Higginbotham
for Chief, Safety and Special
Radio Services Bureau

From League Lines, August 1974:

In a letter explaining that Section 97.112 prohibits "swap and shop" activity on amateur nets, FCC said: "A licensed amateur could use his station from time to time to discuss the availability of a piece of his amateur radio equipment, but such activity would be limited to that of an occasional nature and could not include any items of a personal nature such as a camera, ordinary radios, etc., nor could this activity be conducted on a regularly scheduled basis."

MINUTES OF THE 1984 ANNUAL MEETING OF THE BOARD OF DIRECTORS
THE AMERICAN RADIO RELAY LEAGUE, INC.
MARCH 26-27, 1984

AGENDA

1) Roll Call
2) Moment of Silence
3) Consideration of the agenda for the meeting
4) Approval of Minutes of Second 1983 Meeting
5) Supplementary oral reports by the officers
6) Receive reports and consider recommendations of the committees
7) Acceptance of reports
8) Election of Officers
9) Election of directors to Executive Committee
10) Appointment of Committees
11) Election of ARRL Foundation Directors
12) Consideration of Proposed IARU Constitution and Bylaws
13) Directors motions
14) Authorizations of certain administrative expenses for 1984
15) Consideration of dates for Second 1984 Meeting

1) Pursuant to due notice, the Board of Directors of the American Radio Relay Relay League, Incorporated, met in annual session at the Sheraton-Hartford Hotel, in Hartford, Connecticut, March 26, 1984. The meeting was called to order at 9:08 A.M. with President Carl L. Smith, WØBWJ, in the Chair and the following Directors present:

Thomas B.J. Atkins, VE3CDM, Canadian Division;
Frank M. Butler, Jr., W4RH, Southeastern Division;
Lys J. Carey, KØPGM, Rocky Mountain Division;
George A. Diehl, W2IHA, Hudson Division;
Paul Grauer, WØFIR, Midwest Division;
Jay A. Holladay, W6EJJ, Southwestern Division;
Clyde O. Hurlbert, W5CH, Delta Division;
Mary E. Lewis, W7QGP, Northwestern Division;
Edmond A. Metzger, W9PRN, Central Division;
Gay E. Milius, Jr., W4UG, Roanoke Division;
Leonard M. Nathanson, W8RC, Great Lakes Division;
Tod Olson, KØTO, Dakota Division;
William J. Stevens, W6ZM, Pacific Division;
John C. Sullivan, W1HHR, New England Division;
Hugh A. Turnbull, W3ABC, Atlantic Division;
Raymond B. Wangler, W5EDZ, West Gulf Division.

Also in attendance as members of the Board without vote were Larry E. Price, W4RA, First Vice President; Garfield A. Anderson, KØGA, Vice President; Richard L. Baldwin, W1RU, International Affairs Vice President; and David Sumner, K1ZZ, General Manager. Also in attendance at the invitation of the Board as non-participating observers were the following vice directors: Richard P. Beebe, K1PAD, New England Division; C. Richard Dyas, WØJCP, Midwest Division; Evelyn D.

Gauzens, W4WYR, Southeastern Division; M. L. Gibson, W7JIE, Northwestern Division; Fried Heyn, WA6WZO, Southwestern Division; George W. Hippisley, K2KIR, Atlantic Division; John C. Kanode, N4MM, Roanoke Division; Stephen A. Mendelsohn, WA2DHF, Hudson Division; Marshall Quiat, AGØX, Rocky Mountain Division; Robert P. Schmidt, W5GHP, Delta Division; and George S. Wilson, III, W4OYI, Great Lakes Division. There were also present Past President Harry J. Dannals, W2HD; Honorary Vice President Robert York Chapman, W1QV; Treasurer James E. McCobb, K1LLU; Counsel Christopher D. Imlay, N3AKD; Canadian Counsel B. Robert Benson, QC, VE2VW; Assistant to the General Manager W. Dale Clift, WA3NLO; Club & Training Department Manager Stephen C. Place, WB1EYI; Communications Department Manager John Lindholm, W1XX; Membership Services Department Manager Harold M. Steinman, K1ET; Technical Department Manager Paul Rinaldo, W4RI; and Washington Area Coordinator Perry F. Williams, W1UED.

2) The assembly observed a moment of silence in recollection of Past President Victor C. Clark, W4KFC, mountaineer and arctic explorer Naomi Uemura, JG1QFW, and other amateurs who have passed away since the previous Meeting of the Board.

3) The Chair welcomed, as first time attendees at the meeting, Vice Director Robert P. Schmidt, W5GHP, and Club & Training Department Manager Stephen C. Place, WB1EYI.

4) On motion of Mr. Sullivan, seconded by Mr. Nathanson, it was unanimously VOTED that items 8 and 9 of the agenda be placed before item 4. Whereupon, without dissent, the agenda was adopted as amended.

5) The Board then proceeded to the election of officers. The Chair appointed Messrs. Beebe, Wilson and Mendelsohn as Tellers. The Chair declared that nominations for President were open. Mr. Stevens nominated Mr. Price. Mr. Grauer nominated Mr. Smith. On motion of Mrs. Lewis, seconded by Mr. Butler, it was unanimously VOTED that nominations are closed. Voting was by secret ballot. The tellers found 9 ballots for Mr. Price, 7 for Mr. Smith. Accordingly, Mr. Price was declared elected. (Applause.) The Board was in recess from 9:23 to 9:46 A.M. Mr. Price spoke briefly in appreciation for his election.

6) The Chair declared nominations open for First Vice President. Mr. Wangler nominated Mr. Smith, but Mr. Smith declined the nomination with thanks. Mr. Grauer nominated Mr. Metzger. Mr. Turnbull nominated Mr. Olson. Mr. Hurlbert nominated Mr. Nathanson. Mr. Carey nominated Mr. Anderson. On motion of Mr. Butler, seconded by Mr. Holladay, it was unanimously VOTED that nominations are closed. The tellers found 8 ballots for Mr. Nathanson, 5 ballots for Mr. Olson, 2 ballots for Mr. Anderson, and 1 ballot for Mr. Metzger. A clear majority not having been attained, a second ballot was taken. The tellers found 10 votes for Mr. Nathanson, 5 votes for Mr. Olson, and 1 vote for Mr. Anderson. Whereupon, Mr. Nathanson was declared elected. (Applause.)

7) The Chair declared nominations open for an additional Vice President. Mr. Olson nominated Mr. Anderson. Mr. Sullivan nominated Mr. Holladay. On motion of Mr. Metzger, seconded by Mrs. Lewis, it was unanimously VOTED that

nominations are closed. The tellers found 10 ballots for Mr. Anderson, 6 ballots for Mr. Holladay. Accordingly, Mr. Anderson was declared elected. (Applause.)

8) The Chair declared nominations open for an additional Vice President. Mr. Grauer nominated Mr. Holladay. Mr. Nathanson nominated Mr. Stevens. On motion of Mr. Wangler, seconded by Mrs. Lewis, it was unanimously VOTED that nominations are closed. The tellers found 9 ballots for Mr. Holladay and 7 ballots for Mr. Stevens. Accordingly, Mr. Holladay was declared elected. (Applause.)

9) The Chair declared nominations open for International Affairs Vice President. Mr. Sullivan nominated Mr. Baldwin. Mr. Milius nominated Mr. Smith. On motion of Mr. Olson, seconded by Mrs. Lewis, it was unanimously VOTED that nominations are closed. The tellers found 9 ballots for Mr. Baldwin and 7 ballots for Mr. Smith. Accordingly, Mr. Baldwin was declared elected. (Applause.)

10) On motion of Mr. Hurlbert, seconded by Mr. Nathanson, at 10:21 A.M. it was VOTED, 9 votes in favor to 7 votes opposed, that the Board resolve itself into a Committee of the Whole to discuss election matters.

11) The Board rose from the Committee of the Whole at 11:58 A.M. On motion of Mr. Holladay, seconded by Mr. Stevens, it was unanimously VOTED to accept the report of the Committee of the Whole.

12) The Chair announced the opening of nominations for Secretary. Mr. Holladay nominated Mr. Sumner. On motion of Mr. Nathanson, seconded by Mr. Milius, it was unanimously VOTED that nominations be closed, and that Mr. Sumner be elected as Secretary by acclamation.

13) The President declared nominations open for the office of Treasurer. Mr. Stevens nominated Mr. McCobb. On motion of Mr. Nathanson, seconded by Mr. Turnbull, it was VOTED that nominations be closed and that Mr. McCobb be declared elected. Mr. Grauer requested that he be recorded as voting opposed.

14) The Chair declared nominations open for the position of Honorary Vice President. Mr. Grauer nominated George Hart, W1NJM, retired Communications Manager of ARRL. On motion of Mr. Sullivan, seconded by Mr. Carey, it was unanimously VOTED that nominations are closed. Mr. Nathanson requested that voting be by secret ballot. There being 9 affirmative votes, Mr. Hart was declared elected as an Honorary Vice President. The Board was in recess for luncheon and the taking of the official photograph from 12:13 P.M. until 1:55 P.M., reconvening with all persons hereinbefore mentioned present.

15) The Chair declared nominations open for four Directors to serve on the Executive Committee for one year. Mr. Holladay nominated Mr. Turnbull. Mr. Metzger nominated Mr. Grauer. Mr. Butler nominated Mr. Wangler. Mr. Hurlbert nominated Mr. Milius. Mr. Stevens nominated Mrs. Lewis. Mr. Stevens nominated Mr. Carey. Mr. Holladay nominated Mr. Atkins. On motion of Mr. Olson, seconded

by Mr. Nathanson, it was unanimously VOTED that nominations are closed. With nine votes required for election, at the end of the first ballot, it was announced by the tellers that Mr. Grauer and Mr. Turnbull were elected. After the second ballot, Mr. Carey was declared elected. A third ballot being inconclusive, on the fourth ballot Mr. Milius was declared elected. Thus, Messrs. Grauer, Turnbull, Carey and Milius are elected for a one-year term.

16) Returning to agenda item 4, on motion of Mr. Nathanson, seconded by Mr. Milius, it was unanimously VOTED that the Minutes of the 1983 Second Meeting are approved in the form in which they were issued by the Secretary.

17) Reports of the officers were the next order of business, at agenda item 5. The President's written report chronicled the shock and sadness with which the amateur community greeted the death of Victor Clark, W4KFC, President of ARRL. Top priority projects for 1983 had been implementation of a viable program for voluntary administration of license examinations and monitoring responsibilities; development of a more continuous Washington presence; revitalization of the Intruder Watch Program under the new name, ARRL Interference Reporting System; strengthening and revising the relationship between CRRL and ARRL during the course of a five-year program; changing of procedures to improve Board operating efficiency; field organization restructuring; and a program to establish a new class of club affiliation, called Special Service Clubs. Thirty additional subjects were listed as action items for 1983; 14 have been accomplished, 12 are presently in action and 4 await implementation. Foremost among accomplishments was dismissal of FCC's No-Code proposal; space-to-ground communication from W5LFL during the STS-9 mission; and the preparation of the "Amateur Radio's Newest Frontier" videotape by Roy Neal, K6DUE, and a team of assistants with the full cooperation of the National Aeronautics and Space Administration (NASA). Other items included expansion of the 20-meter phone band, recruiting of lawyer/amateurs as volunteer counsel, improvement of the staff retirement program, formation of a digital committee, support for and participation in the reorganization of IARU, reestablishment of the Hiram Percy Maxim Memorial Award, participation in the WARIC Conference organized by JARL for World Communications Year, and active participation in the IARU Region II Conference, Cali, Colombia. Attention was also focused on cable television interference problems, the seeking of federal preemption of amateur antenna regulation, efforts to effect implementation of the 18, 24 and 902 MHz WARC bands, regulatory efforts to address the biological effects of RF energy, and the seeking of a reciprocal licensing agreement with Japan.

18) First Vice President Price presented his report, also beginning with the tragic news of Vic Clark's death which, among other things, resulted in Mr. Price becoming Vice President of IARU upon his becoming First Vice President. The report covered travel during the year to numerous hamfests and conventions throughout the country. Vice President Price also took part in meetings of several committees: Membership Affairs, Management and Finance, Executive Committee, Forward Planning Committee, and the Committee of Tellers. He also served as Chairman of the Ad Hoc Committee on the ARRL Interference Reporting System, and a subcommittee on volunteer monitoring. The AIRS program became operational early in 1984, and drafting of material in connection with the

voluntary monitoring program continues. Goals for 1984 include efforts to achieve exemption for ARRL from property and sales taxes in Connecticut, reviewing and revising ARRL technical publications, a management training development program, and a grassroots program to recruit and retain League members.

19) Vice President Anderson presented his report, paying tribute to President Clark. Committee assignments included Membership Affairs, the Ad Hoc Committee on Volunteer Examining-Monitoring and meetings of the Executive Committee. Travel included attendance at the Dakota Division Convention in Sioux Falls.

20) International Affairs Vice President Baldwin presented his report covering two principal projects: restructuring of IARU through development of a new constitution, and seeking a reciprocal operating agreement between the United States and Japan. Travel included a trip to Tokyo to participate in the first meeting of the Administrative Council, a visit to Germany and Geneva to discuss restructuring and visit ITU officials, participation in the World Amateur Radio International Conference in Japan and another visit to Geneva in October in preparation for the HF Broadcasting WARC.

21) General Manager Sumner highlighted and updated his report beginning with the tragedy and triumphs of November and December: the sudden death of President Clark, congressional action on VEC reimbursement, and final FCC action on No-Code. The General Manager reported his belief that the League today is stronger than it has been at any time in recent memory, effective in Washington both at FCC and on Capitol Hill and with membership growing in 1983 at a rate faster than the licensing figures. Public attention was focused on amateur radio during the Grenada crisis and by W5LFL's operation from space. Financial results were favorable, with an all-time high in general fund reserves at the $1.6 million mark. His report also covered actions in response to motions from previous Board meetings, finance and budget matters, personnel, and publications, particularly the new Satellite Experimenter's Handbook, a revised and greatly improved Repeater Directory now at the printer, a new edition of the FCC Rule Book, and a new edition of Tune in the World, just received from the printer.

22) The report continued with a discussion of QST content and mailing, a new system for QST Product Review, and promotion of membership in ARRL, including lower multiple-year rates for ARRL membership of $47 for two years or $65 for three years that will become effective at the close of the meeting. The roster of special service clubs has grown, but additional programs that are planned are needed to make this category still more attractive. Much has been done to upgrade and improve W1AW and other improvements are planned. Programs to standardize radio equipment connectors, to encourage experimentation with HF DF and discussion of the work in Washington concluded the report. During the course of this presention, Mr. Schmidt took the seat for Mr. Hurlbert from 3:02 to 3:55. The Board was in recess from 3:18 to 3:43.

23) Mr. McCobb, Treasurer, reported that $185,000 was realized from interest and dividends in the regular portfolio, contributing to a peak in the

ARRL general fund at $1,635,100. The number of Life Members rose to 18,760 from 16,062 at the end of 1982, and 394 were in the process of becoming Life Members. Funds for this group had a market value of $3,444,700 with a book value of $3,794,800. Comparable 1982 figures were $2,897,000 and $3,302,000. The Life Membership portfolio generated $325,000 in interest and dividends during the year.

24) Counsel Imlay presented and highlighted an extensive report. Some topics: WARC-79 frequency bands; request for authorization of F1 in the 160-meter band; efforts to obtain reimbursement in the VEC program; efforts directed toward federal preemption of local antenna regulation; the manner in which the League responds to requests for assistance in legal cases; Docket 83-806 in reference to rf-emitting light bulbs; cable television interference; the commercial linear amplifier ban between 24 and 35 MHz; expansion of RACES authorizations; simplex autopatch; and amateur antenna litigation on the local level.

25) Canadian Counsel Benson covered municipal regulation of antennas, the inadvisability of a separate foundation in Canada, second class mailing privileges for QST, and trademark matters.

26) Honorary Vice President Chapman, in his capacity as President of the ARRL Foundation, presented his report, which shows that 129 individuals have donated over $11,000 to the Barry M. Goldwater Scholarship Fund, while 186 amateurs have contributed more than $8,200 in memory of ARRL President Victor C. Clark, W4KFC. Scholarship and organizational matters were also covered.

27) Next came agenda item 6: Receive reports and consider recommendations of committees. First was the Plans and Programs Committee report, presented by Mr. Carey, as Chairman. The Committee had discussed at length the opportunities and problems associated with new features in digital communication, including message storage centers and computer based message systems.

28) Mr. Sullivan, as Chairman, presented the report of the Membership Affairs Committee. It was moved by Mr. Anderson, seconded by Mr. Wangler, that Bylaw 32 be revised to read as follows (underlined words to be added):

> In the event of a temporary absence or disability of the President, the First Vice President shall preside at the meetings of the Board of Directors and in general act in his stead. Should the First Vice President be also absent or unable to act, the Vice Presidents shall succeed in order of their election. In the event of the resignation, permanent incapacitation, or death of the President, the First Vice President shall succeed him, or in his absence, or being unable to act, the Vice Presidents shall succeed him in the order of their election.

It was moved by Mr. Nathanson, seconded by Mr. Hurlbert, that the motion be amended to add the words, "as determined by the Executive Committee,"

after the phrase, "permanent incapacitation." After further discussion, on motion of Mr. Stevens, seconded by Mr. Milius, the matter was laid on the TABLE.

29) On motion of Mr Atkins, seconded by Mr. Milius, the following resolution was ADOPTED:

WHEREAS, interest has been expressed in the development of an information source, or clearing house, which would have on file the names and addresses of amateurs in the United States and Canada who are interested in exchanging vacations and/or making travel arrangements with amateurs in other countries,

IT IS THEREFORE RESOLVED that the Headquarters staff is requested to investigate the feasibility of setting up and maintaining a central register of amateurs wishing to participate in such an exchange plan, and also to explore the degree of interest and the possibility of participation by other IARU member societies.

Mrs. Lewis requested to be recorded as voting in the negative.

30) On motion of Mr. Sullivan, seconded by Mrs. Lewis, it was unanimously VOTED that the Technical Excellence Award for 1982, an engraved pewter bowl, be presented to Wes Hayward, W7ZOI, for his article in May, 1982 QST, "A Unified Approach to the Design of Crystal Ladder Filters."

31) Mr. Stevens, as Chairman, presented the report of the Management & Finance Committee. The committee had determined that a change to four-year terms for ARRL Directors was feasible; however, informal indications from Directors were that there was insufficient support for passage, so no motion was to be presented. Other subjects covered in the report included headquarters management development and training, the expenses of volunteers, a negative recommendation on basing Life Membership dues on actuarial assumptions, encouraging bequests for the ARRL Foundation, production of a sample ARRL display booth that is easily portable, audit and investment matters, a return to the 5-day work week for employees, and disposing of product review equipment by the highest mail bid. The Board was in recess for dinner from 5:41 P.M. until 8:35 P.M., reconvening with all persons hereinbefore mentioned present except Messrs. Hurlbert, Baldwin, and McCobb. Mr. Schmidt took the seat for Mr. Hurlbert.

32) Mr. Butler, as liaison, presented the report of the VHF Repeater Advisory Committee, which continues to work on suitable band plans for 1240-1300 MHz and for the proposed band at 902-928 MHz, and on possible revisions to the six-meter band plan.

33) Mr. Olson, as Liaison, presented the report of the Contest Advisory Committee. A contest code of ethics has been constructed, but the Committee has not yet reached consensus on adoption and forwarding to the Board of Directors.

34) Mr. Kanode, as Liaison, presented the report of the DX Advisory Committee. Topics included expansion of the DXCC awards program, country status

of the Spratly Islands, accreditation criteria, a questionnaire on a wide range of DX matters circulated within the committee, and voting now underway on country status for the Pribilof Islands and 4U1VIC in Vienna. On motion of Mr. Stevens, seconded by Mr. Diehl, it was VOTED, that, in concert with the rationale presented in Minute 65 of the annual meeting of 1983 and with the recommendation of the DXAC, endorsements for RTTY DXCC shall be available beginning 1 August 1984 for contacts made on or after 15 November 1945. The same provisions as apply to the cw and phone DXCC awards would prevail, with the exception that there would be no Honor Roll.

35) On motion of Mr. Stevens, seconded by Mr. Diehl, it was VOTED that, in response to the recommendation of the DX Advisory Committee, the ARRL Awards Committee and the DXAC jointly develop the details of implementing additional endorsable DXCC awards with implementation of the same to begin no later than January 1, 1985, and with the Board to be apprised of such prior to implementation.

36) Mr. Sullivan, as Liaison, presented the report of the Emergency Communications Advisory Committee, which took the form of an exchange of letters between the Liaison and the ECAC members probing reasons for ineffectiveness of the committee. Directors were urged to monitor performance of advisory committee members, replacing those who are inactive.

37) At 8:55 P.M., Mr. Mendelsohn took the seat for Mr. Diehl.

38) As Liaison, Mr. Mendelsohn presented the report of the Public Relations Advisory Committee which was implemented by the following series of motions. On motion of Mr. Mendelsohn, seconded by Mr. Nathanson, it was unanimously VOTED that, with the obvious success of the STS-9 Owen Garriott Ham in Space Mission and the added recognition afforded our hobby by the recent Grenada situation, it has become evident to many that there has been a great deal of maturation in the ability of the Headquarters Public Information staff. Therefore, the General Manager is encouraged to consider that all public relations functions currently existing at ARRL Headquarters be centralized within the Public Information Office. This would include, but not be limited to, such items as topical press releases, press and public contact, and the writing of general information handouts for the press and public. Such items as recruiting pamphlets, however, would remain within the Club and Training Department.

39) On motion of Mr. Mendelsohn, seconded by Mr. Stevens, it was unanimously VOTED that the General Manager is directed to put into production the press kit as designed by the PRAC, the pamphlet, "Amateur Radio, A National Resource," as designed by the PRAC, and individual "targeted" pamphlets as displayed at the meeting.

40) On motion of Mr. Mendelsohn, seconded by Mr. Holladay, it was VOTED that the proposal of the PRAC, in accordance with minute 80 of the Second 1983 Board Meeting, to produce a slide and sound presentation designed to illustrate to potential user organizations, such as the Red Cross, the advantages and limi-

tations of Amateur Radio participation in their public service events, be accepted. The President shall appoint a special committee to produce the aforesaid presentation. The committee shall consist of at least the board liaison, the staff liaison, and six members of the PRAC. Funding up to a maximum of $2,000 is authorized for this project.

41) At 9:10 Mr. Baldwin returned to the meeting, and Mr. Diehl resumed his seat.

42) Mr. Holladay, as Liaison, presented the report of the VHF/UHF Advisory Committee. It continues its work on a number of band plans in conjunction with the VHF Repeater Advisory Committee, and expects to have the plans complete for the next meeting of the Board.

43) At the request of the Chair, Mr. Clift presented the report of the Executive Committee on the ways in which ARRL responds to requests for legal assistance received from members. The report recommended that the legal assistance program continue to be decentralized particularly by fostering the volunteer counsel program. Establishment of a better clearinghouse for legal materials, concerted efforts toward federal preemptive legislation, and participation in landmark cases as a friend of the court were urged. Proposals at state levels should be monitored especially by the state government liaisons appointed by the ARRL Section Managers. Finally, there should be adequate explanations of the legal assistance program in QST.

44) Mr. Price, as Chairman, presented the report of the Committee of Tellers. On motion of Mr. Price, seconded by Mr. Metzger, it was unanimously VOTED that the Standard Operating Procedures annexed to the report of the Committee of Tellers is adopted as a standing order of the Board.

45) Mr. Price, as Chairman, presented the report of the Ad Hoc Committee on the ARRL Interference Reporting System (AIRS) outlining the renaming of the old Intruder Watch system, selection and approval of AIRS members, microcomputer maintenance of the data base, appointment of an AIRS coordinator at Headquarters, printing and distribution of AIRS forms and activation of the system which was accomplished earlier this year.

46) Mr. Turnbull, as Chairman, presented the report of the Ad Hoc Committee on a More Continuous Washington Presence. The Committee had two tasks: developing a more continuous Washington presence for ARRL, and studying all facets of obtaining a Congressional charter for the League. In response to the first task, W. Dale Clift, WA3NLO, has been designated as staff backup for the Washington Area Coordinator, and has made several trips to Washington for indoctrination. In addition, Capt. Charles Dorian, W3JPT, has been retained as associate Washington coordinator on a consultant basis a few days per month. An intelligence network is in place, and a membership response procedure, for use when there are legislative or regulatory problems, has been presented to the Board. The report included a recap of the League's legislative and regulatory objectives and a summary of efforts in the Washington area by the Washington Area Coordinator and others, with the following issues highlighted: FCC's

"no-code" proposal, the volunteer examiner program, legislation permitting recoupment of expenses, cooperation with the National Communications System, membership on the National Industry Advisory Committee, participation in the World Communications Year, assistance to the U.S. Telecommunications Training Institute, and participation in planning for Caribbean hurricanes under the auspices of the Department of State.

47) Mr. Atkins, as Chairman, presented the report of the Ad Hoc Committee on the Strengthening of CRRL. The implementation of the 5-year plan is proceeding on schedule and all matters planned for 1983 except for Canadian mailing of QST have been completed. Funds have been provided for operation of CRRL Headquarters in London, Ontario, for 1984. It was moved by Mr. Atkins, seconded by Mr. Sullivan, that existing paragraph 7 of the "Rules and Regulations Concerning Affiliated Societies" is redesignated paragraph 8, and a new paragraph 7 is added, as follows: "7. Amateur radio clubs and groups in Canada are invited to affiliate with the Canadian Radio Relay League, which shall adopt its own standards for affiliation. Canadian clubs and groups affiliated with ARRL as of December 31, 1984, are deemed to be affiliated with CRRL." A roll call vote being required, the question was decided in the Affirmative with all directors voting aye. Accordingly, the rules and regulations were AMENDED.

48) It was moved by Mr. Atkins, seconded by Mr. Sullivan, that Article 4 of the Articles of Association and By-Laws be amended to read: "The affairs of the Corporation shall be governed by a Board consisting of sixteen Directors, each representing a territorial Division comprising a geographical area as defined in the By-Laws. One Division shall be known as the Canadian Division, or alternatively as the Canadian Radio Relay League, and shall comprise the provinces and territories of Canada. Except for the Director of the Canadian Division, the Director shall be elected for terms of two years by the members eligible to vote. Seven Directors shall be elected for terms beginning on even-numbered years and eight Directors shall be elected for terms beginning on odd-numbered years. The President of the Canadian Radio Relay League as duly elected by that body shall serve as the Director of the Canadian Division. Election of other Directors shall be by mail vote in accordance with the rules and regulations prescribed in the By-Laws. The Board shall meet twice each year at times and places as provided in the By-Laws. The first meeting shall be called the Annual Meeting and the second shall be called the Second Meeting. Special meetings of the Board shall be called by the President upon written request of at least one-half of the membership of the Board as then constituted." A roll call vote being required, the question was decided in the affirmative, with all directors voting aye. Accordingly, Article 4 was AMENDED.

49) It was moved by Mr. Atkins, seconded by Mr. Sullivan, that Article 5 be amended by adding the following sentence: "The Secretary of the Canadian Radio Relay League, as duly elected by that body, shall serve as the Vice-Director of the Canadian Division." A roll call vote being required, the question was decided in the affirmative, with all directors voting aye. Accordingly, Article 5 was AMENDED.

50) It was moved by Mr. Atkins, seconded by Mr. Sullivan, that Article 7 be amended by beginning the paragraph with the following additional phrase:

"Except in the Canadian Division . . ." A roll call vote being required, the question was decided in the affirmative, with all directors voting aye. Accordingly, Article 7 was AMENDED.

51) It was moved by Mr. Atkins, seconded by Mr. Sullivan, that By-Law 23 be amended by deleting "Canadian,. . ." A roll call vote being required, the question was decided in the affirmative, with all directors voting aye. Accordingly, By-Law 23 was AMENDED.

52) Mr. Anderson, as Chairman, presented the report of the Ad Hoc Committee on Volunteer Examining-Monitoring. The Committee report included a 90-page document, entitled "Background Material for Proposed Operating Agreement," developed to describe the ARRL Volunteer Examiner Program in detail. It was moved by Mr. Anderson, seconded by Mr. Nathanson, that the ARRL become a VEC on a national basis and therefore, on the effective date of rules adopted in PR Docket No. 84-265 to permit the recoupment of expenses by the Volunteer Examiner Coordinators in accordance with Public Law 98-214, the President and General Manager are hereby authorized to conclude, on behalf of the ARRL, an agreement with the FCC for the ARRL to serve as VEC for the 13 FCC-defined regions, such agreement to be consistent with "Background Material for Proposed Operating Agreement" annexed to the Report of the Ad Hoc Committee on Examining-Monitoring as amended at this meeting. It was moved by Mr. Wangler, seconded by Mr. Butler, that the motion be amended by deleting "on the effective date of rules adopted in PR Docket No. 84-265 to permit the recoupment of expenses by Volunteer Examiner Coordinators in accordance with Public Law 98-214..." The ayes and nays on the amendment being ordered by request, the motion was LOST 3 votes in favor to 12 opposed, with Mr. Atkins abstaining. Mr. Wangler requested to be recorded as voting in favor of the amendment. Whereupon, the question being on the motion as originally presented, the same was unanimously ADOPTED, Mr. Atkins again abstaining.

53) Mr. Price, as Chairman, presented the report of the Ad Hoc Subcommittee on Volunteer Monitoring. Public Law 97-259 authorized FCC to use volunteers both in the examination process and in monitoring amateur activities on the air. The subcommittee was appointed to make recommendations in continuation and enhancement of amateur self-policing. A motion will be presented later in the meeting.

54) Mr. Dyas, as Chairman, presented the report of the Ad Hoc Committee for an ARRL International Humanitarian Award. The objectives of the award, the gathering of voluntary contributions to support the award and procedures for determining its winner are outlined in the committee report. On motion of Mr. Grauer, seconded by Mr. Milius, it was unanimously VOTED that the ARRL Board establish the ARRL International Humanitarian Award as proposed in the Ad Hoc Committee report.

55) On behalf of Chairman Andrea Parker, Mr. Price presented the report of the Goldwater Scholarship Committee. The committee developed a formal description of the Goldwater Scholarship and a formal application form. The report recommended continuance of the committee to serve as a screening and selection body for the initial recipient.

56) Mr. Holladay, as Chairman, presented the report of the Ad Hoc Committee on Forward Planning, comprising some 28 pages. In the course of its work, a survey of Section Managers was made, and a questionnaire designed to test the continued validity of the 1980 Florida State University survey results was sent to a small sample of amateur licensees. The recommendations of the committee will be made by separate motion later in the meeting. During the course of the above, at 9:56 P.M., Mr. Dyas took the seat for Mr. Grauer, and Mr. Beebe took the seat for Mr. Sullivan.

57) Mr. Olson, as Chairman, presented the report of the Ad Hoc Committee on Computer Based Message Systems. As a result of discussion, it was decided to build a test computer based message system for use by the Board and it is operating on a pilot basis. A list of information elements which might be of interest to Board members and an economic analysis of the cost of such a system were also prepared by the Committee.

58) Mr. Turnbull, as Chairman, presented the report of the Radio Frequency Interference Task Group whose work has included reviewing the text of the RFI chapter for the 1985 Handbook; reviewing radio frequency interference reports received at Headquarters; and cable television interference, including formation of a joint ARRL/National Cable Television Association Committee with FCC as a party to work out interference problems not resolvable at the local level. Members of the Task Group also visited a state-of-the-art cable system outside Washington. The Task Group also assisted in preparing ARRL comments concerning RF light bulbs and is participating in ad hoc committee C63 of the American National Standards Institute concerning the RF immunity of consumer devices. Harold Richman, W4CIZ, is in the process of updating the RFI assistance list. Mr. Turnbull has attended two symposiums on cable television, in Nashville and in Oklahoma City. During the course of the above report, at 10:15 P.M., Mr. Quiat took the seat for Mr. Carey.

59) Mr. Wangler, as Chairman, presented the report of the Committee on Biological Effects of RF Energy. The report covers local and state attempts to adopt their own limits on RF energy, the committee's preference for a national standard based on ANSI C95.1-1982, development of a guideline within the Environmental Protection Agency, and efforts to have FCC adopt limited preemption of the field. The Committee assisted the preparation of a petition for expedited special relief and declaratory ruling in General Docket 79-144 which has been filed by the ARRL Counsel.

60) Mr. Quiat presented the report of the Ad Hoc Committee on Amateur Radio Digital Communication. On motion of Mr. Quiat, seconded by Mr. Butler, it was unanimously VOTED that the Ad Hoc Digital Committee, with the assistance of staff and counsel, is instructed to draft a petition for FCC rulemaking, such petition to authorize, specifically, automatic control of digital communications on all amateur bands, and include: 1) adequate provisions and safeguards, 2) unattended transmission and reception, 3) unattended message systems. This report shall be tendered by the Committee to the Board at the Board's second meeting of 1984.

61) On further motion of Mr. Quiat, seconded by Mr. Atkins, it was unanimously VOTED that the following interim recommendations of the Committee be approved as a standard for good practice for digital communications:

Establishment of New Systems

New CBMSs should serve a need within the basis and purpose of Amateur Radio as stated in Section 97.1 of the FCC rules and not simply add to congestion by duplicating services already available.

Frequencies should be selected in accordance with the ARRL band plans.

VHF and UHF channels should be coordinated with the appropriate frequency coordinator(s).

Frequencies in the HF bands should be time-shared with existing CBMSs to the extent possible in coordination with the other CBMS operators using that same frequency.

Where sharing of an existing frequency is not feasible, new channels should be selected near the upper portion of the particular RTTY subband, leaving the lower parts of the RTTY subband to DX and other operator-to-operator QSOs.

Operational Safeguards

CBMSs should listen before transmitting. The system should sense activity on the channel and not transmit until the channel goes free. This can be accomplished by a carrier-detect circuit.

Incoming messages should not be retransmitted until read and released by the CBMS operator.

Until such time that the FCC permits unattended automatic operation of HF CBMSs, CBMS operators should monitor their transmissions (at least aurally) at all times that the CBMS is on the air and have a reliable method of terminating transmission in the event of malfunction. Monitoring may be done from a remote location.

The system should have software provisions to limit specific responses to a maximum of 10 minutes. Longer responses should be interrupted at least every 10 minutes for a go-ahead from the other station.

The system should have a hardware "watchdog" timer to limit individual transmissions to 10 minutes.

In order to make the channel available to other stations, CBMS operators should cull files that are out of date and offer user instructions for an s.a.s.e. by mail.

A CBMS operator should establish and make public a policy regarding acceptance of borderline traffic such as that relating to sale of equipment after reviewing current FCC rules and interpretations.

User Operating Practices

Monitor the frequency for a short period before calling a CBMS.

Do not interrupt another station using a CBMS.

Do not interfere with a QSO on or near the frequency.

Always properly identify your station.

Keep your signals on frequency.

Do not list "for sale" items without prior permission of the CBMS operator.

Make sure that you deactivate the CBMS by using that system's correct EXIT command.

62) Mr. Nathanson, as Chairman, presented the report of the Ad Hoc Committee on Legal Preemption. The Committee discussed the SMA TV ruling of the FCC, a favorable decision that may be expanded. The Committee has decided to seek a joint resolution of Congress preempting local or state regulations that would interfere, limit, or proscribe amateur radio communications.

63) Moving now to agenda item 7, on motion of Mr. Stevens, seconded by Mr. Nathanson, it was unanimously VOTED that the reports of the officers and committees are accepted and placed on file.

64) The Board was in recess from 10:25 P.M. until 8:33 A.M. the following day, reconvening with all present except Mr. McCobb and Mr. Place. During the course of the second day Mr. Hurlbert left the meeting several times due to family medical problems; during his absences Mr. Schmidt took his place at the Table. Past Director L. Phil Wicker, W4ACY, was also in attendance.

65) Turning now to agenda item 10, President-Elect Price appointed the following standing committees:

Management & Finance

Mr. Metzger, Chairman

Mr. Olson, Alternate Chairman
Mr. Stevens
Mr. Hurlbert
Vice President Nathanson
Treasurer McCobb (ex-officio)

Membership Affairs

Mr. Butler, Chairman
Mr. Diehl, Alternate Chairman
Mr. Wangler
Mr. Atkins
Vice President Anderson

Plans & Programs

Mr. Sullivan, Chairman
Mrs. Lewis, Alternate Chairman
Mr. Wilson
Mr. Heyn
Vice President Holladay

66) The Chair presented the report of the Official Availability Committee for ARRL Foundation Directors; whereupon, on motion of Mr. Nathanson, Mr. Grauer, Mr. Diehl, and Mr. Chapman were elected to the Foundation Board by acclamation. (Applause.)

67) Turning now to agenda item 12, on motion of Mr. Baldwin, seconded by Mr. Sullivan, at 8:44 A.M., it was unanimously VOTED that the Board resolve itself into a Committee of the Whole to discuss IARU matters.

68) The Board rose from the Committee of the Whole at 9:20 A.M. During the course of the Committee of the Whole Mr. Wilson and Mr. Wicker departed from the meeting. On motion of Mr. Nathanson, seconded by Mr. Wangler, it was unanimously VOTED to accept the report of the Committee of the Whole.

69) Turning now to agenda item 13, Directors'motions, there was extensive discussion and review of submissions of proposed logos for Special Service Clubs. On motion of Mr. Sullivan, seconded by Mr. Wangler, it was unanimously VOTED to accept the Special Service Club logo design submitted by Jeffrey J. Duquette, K1BE, of Southwick, Massachusetts, as the official Special Service Club logo. Runners up were submissions by Roy S. Blackshear, KH6BAI, Mike Bokulich, K8US, Jim Talcott, N6JSV, and Mike Lowden, N9CRA.

70) On motion of Mrs. Lewis, seconded by Mr. Milius, it was unanimously VOTED that the ARRL Headquarters Awards Committee, in conjunction with the DX Advisory Committee, take the necessary actions to clarify and define in greater detail the existing DXCC country criteria, these revised criteria to be printed on the ARRL DXCC Countries List.

71) It was moved by Mr. Stevens, seconded by Mr. Carey, that the Membership Affairs Committee study the purposes and objectives of the advisory committees to determine if it is necessary to modify their functions. On motion of Mr. Olson, seconded by Mr. Sullivan, it was unanimously VOTED that the motion be amended by striking all text after "advisory committees" and substituting therefor "to assure that they continue to provide a useful service to the Board." The question then being on the motion as amended, the same was unanimously ADOPTED.

72) On motion of Mr. Milius, seconded by Mr. Carey, it was unanimously VOTED, Mr. Atkins abstaining, that Counsel is directed to immediately prepare and file with the Federal Communications Commission a motion to expedite issuance of a Report and Order in Docket 82-83, which would expand the telephony sub-bands at 75, 15 and 10 meters as proposed in League comments previously filed in the proceeding.

73) On motion of Mr. Butler, seconded by Mr. Atkins, it was unanimously VOTED that the Executive Committee, with the assistance of staff and Counsel, study the use of simplex autopatch (simpatch) devices with special emphasis on their legality, propriety of use, and suitability for advertising in QST. The Committee shall report to the Board at the Board's next meeting.

74) On motion of Mr. Holladay, seconded by Mr. Butler, it was unanimously VOTED that the Board hereby adopts the statement of publications objectives of the ARRL as contained in the report of the Forward Planning Committee.

75) On motion of Mr. Wangler, seconded by Mr. Holladay, it was unanimously VOTED that in order to better acquaint the ARRL Board with the status and trends of the organizational aspects of international amateur radio, the Board does hereby invite members of the IARU Administrative Council and the Region II Executive Committee to participate in an informal meeting with members of the Board scheduled to be held in Hartford, CT, in the fall of 1984. Mr. Beebe took Mr. Sullivan's seat at the Table at 9:55 A.M.

76) On motion of Mr. Turnbull, seconded by Mr. Atkins, it was unanimously VOTED that the CEE-22 6 Amp standard for AC power connectors is adopted as an ARRL standard. The Amateur Radio equipment industry, and designers of equipment projects for home construction, are encouraged to use these connectors, as appropriate, in their designs.

77) It was moved by Mr. Turnbull, seconded by Mr. Butler, that the Anderson Power Products Powerpole® modular connectors, or equivalents, are provisionally adopted as the ARRL standard for 12 Volt D.C. power connections. The Amateur Radio equipment industry, and designers of equipment projects for home construction, are encouraged to use these connectors, as appropriate, in their designs. ARRL members are encouraged to share with the Headquarters Technical Department any experiences they may have which may bear upon the adoption of a permanent standard for 12 Volt D.C. power connectors. After discussion, on motion of Mr. Price, seconded by Mr. Milius, it was unanimously VOTED that the matter is laid on the Table.

78) On motion of Mr. Olson, seconded by Mrs. Lewis, it was unanimously VOTED that the General Manager is directed to implement a program whereby at the time of first appointment of each Leadership Field Organization Appointee and each Advisory Committee member, they will receive, gratis, the appropriate lapel pin signifying their appointment.

79) It was moved by Mr. Schmidt, seconded by Mr. Stevens, that Counsel be directed to petition the FCC for an 18 MHz amateur allocation on a de-regulated basis, i.e., no sub-bands for the various modes, with all modes being permitted throughout the allocated frequencies limited only by the bandwidth of a conventional, state of the art, SSB signal. After discussion, on motion of Mr. Nathanson, seconded by Mr. Milius, it was unanimously VOTED that the matter is referred to the Plans and Programs Committee for study.

80) On motion of Mr. Nathanson, seconded by Mr. Olson, it was unanimously VOTED that the Membership Affairs Committee is requested to study, and report to the Board at its next meeting, a recommendation for obtaining and distributing a uniform identification badge for the League Official Family for use at hamfests and other events. The Board was in recess from 10:10 until 10:40 A.M., at which time Mr. Sullivan resumed his seat at the Table, and Mr. Wilson returned to the room.

81) On motion of Mr. Sullivan, seconded by Mr. Milius, it was unanimously VOTED that the General Manager make available to the DX Honor Roll members a suitable plaque to recognize their achievement. The General Manager shall establish a suitable price for such a plaque.

82) On motion of Mrs. Lewis, seconded by Mr. Carey, it was unanimously VOTED that in QST publicity for events for which Eastern, Central, and Pacific time are shown, that Mountain time be shown also.

83) On motion of Mr. Milius, seconded by Mrs. Lewis, it was unanimously VOTED that the Public Relations Advisory Committee is requested to develop new approaches of advertising the benefits of ARRL membership.

84) On motion of Mr. Butler, seconded by Mr. Wangler, it was unanimously VOTED that the Board take up the consideration of sites for the 1987 ARRL National Convention. Mr. Wangler submitted for consideration Dallas, Texas. Mr. Butler submitted for consideration Atlanta, Georgia. Mrs. Lewis submitted for consideration Portland, Oregon. Mr. Milius submitted for consideration Charlotte, North Carolina. It was moved by Mr. Stevens, seconded by Mr. Milius, that the matter be Tabled until such time as proper application papers are submitted to the Board, but the motion to Table was LOST. On motion of Mr. Butler, seconded by Mr. Carey, after discussion, it was unanimously VOTED that the 1987 ARRL National Convention shall be held in Atlanta, Georgia.

85) It was moved by Mr. Wangler, seconded by Mr. Stevens, that future VHF-UHF Repeater Directories published by the ARRL include within the directory a designation to show the difference between a repeater that has been coordinated and one that has not. This difference may be shown by those repeaters

that are uncoordinated as being designated by an asterisk. After extensive discussion, it was moved by Mr. Sullivan, seconded by Mr. Grauer, that the matter be referred to the Membership Affairs Committee in consultation with the VHF Repeater Advisory Committee. It was moved by Mr. Stevens, seconded by Mr. Milius, that the matter be laid on the Table, but the motion to Table was LOST. The question then being on the motion to refer the matter to the Membership Affairs Committee in consultation with the VHF Repeater Advisory Committee, the same was unanimously ADOPTED.

86) On motion of Mr. Turnbull, seconded by Mr. Butler, with Mr. Atkins abstaining, the following resolution was unanimously ADOPTED:

"WHEREAS the League has been committed to the concept of self-regulation for some fifty years through its Official Observer program, and

"WHEREAS Public Law 97-259 provides for volunteer amateur assistance in on-the-air monitoring activities, and

"WHEREAS the League is anxious to utilize its Field Organization to implement such formalized activities, and

"WHEREAS the Federal Communications Commission Field Operations Bureau has indicated its desire to cooperate with the League to effect such volunteer assistance, now, therefore,

"BE IT RESOLVED, that the General Manager is directed to sign, on behalf of ARRL, the agreement between ARRL and the Federal Communications Commission Field Operations Bureau to establish an Amateur Auxiliary as presented by the Subcommittee on Monitoring to the Board."

87) On motion of Mr. Atkins, seconded by Mr. Nathanson, it was unanimously VOTED that the General Manager is directed to provide ARRL letterhead on tractor feed paper suitable for computer printers.

88) On motion of Mr. Olson, seconded by Mr. Sullivan, it was unanimously VOTED that the Management and Finance Committee prepare a plan to fund the activities to be supported by the ARRL prior to, and during, the next World Administrative Radio Conference. The plan is to be presented prior to the next Annual Meeting of the Board.

89) It was moved by Mr. Hurlbert, seconded by Mr. Nathanson, that the Board appropriate $5,000.00 for use by the Louisiana Amateur Radio Exhibition, Inc. to assist in the operation and security of a booth at the 1984 World's Fair in New Orleans, Louisiana. Further, that the League, at a minimum cost, make available 50,000 handouts, printed on inexpensive paper for distribution to the most interested visitors to the booth. On motion of Mr. Olson, seconded by Mr. Butler, it was unanimously VOTED to amend the motion by striking the words "at a minimum cost" and substituting therefor "at a cost no greater than $1,000." The question then being on the motion as amended, the same was unanimously ADOPTED.

90) On motion of Mr. Nathanson, seconded by Mrs. Lewis, it was VOTED that the Membership Affairs Committee is requested to study, and present to the Board at its next meeting, a recommendation on whether, and what, items of jewelry bearing the League emblem shall be sold, such items to include, but not be limited to, rings, money clips, tie tacks, lapel pins, and the like. Mr. Dannals left the meeting at 12:00 P.M.

91) On motion of Mr. Diehl, seconded by Mr. Butler, at 12:01, it was VOTED that the Board resolve itself into a Committee of the Whole to discuss elections for honorary office.

92) The Committee of the Whole rose and reported to the Board at 12:17 P.M. On motion of Mr. Diehl, seconded by Mr. Wangler, it was VOTED that the Board bestows upon Harry J. Dannals, W2HD, the title of President Emeritus. (Applause.) Mr. Dannals returned to the room and Mr. Beebe took the seat at the Table for Mr. Sullivan.

93) It was moved by Mr. Beebe, seconded by Mr. Grauer, that the following resolution be adopted:

WHEREAS, the Forward Planning Committee has reviewed the implementation and status of the Field Organization, now, therefore,

BE IT RESOLVED THAT:

1) the section level appointment of Assistant Section Manager be added to the list of appointments in item 9 of the Rules and Regulations of the ARRL Field Organization. This appointment will be optional at the Section Manager's discretion.

2) The field appointment of Awards Administrator be added to the list of appointments in item 10 of the Rules and Regulations of the ARRL Field Organization. The purpose of the Awards Administrator appointment is for the local administration of awards such as VUCC. Preference shall be given to the Special Service Clubs as a source of candidates with the Section Manager delegating appointment authority to the Affiliated Club Coordinator.

3) The Worked All States (WAS) award be added to the VUCC Award as being administered at the section level by the Awards Administrator.

It was moved by Mr. Olson, seconded by Mr. Hurlbert, that the motion be amended by striking the paragraphs numbered 2 and 3. It was moved by Mr. Nathanson, seconded by Mr. Stevens, that the matter be laid on the Table, but the motion to Table was LOST. After discussion, the vote being on the motion to amend, the same was ADOPTED. The question being on the motion as amended, the motion was ADOPTED. During the course of the motion the Board was in recess for luncheon from 12:24 until 1:18 P.M. Mr. Sullivan resumed his seat at the Table.

94) On motion of Mr. Sullivan, seconded by Mr. Baldwin, the following resolution was unanimously ADOPTED:

WHEREAS, Marion Bayrer has served the ARRL and its members loyally and faithfully for nearly half a century, 46 years, while attaining the position of Deputy Circulation Manager, and

WHEREAS, Marion has earned the trust and respect of many members, officials and staff personnel, now, therefore,

BE IT RESOLVED that the ARRL Board of Directors assembled March 27, 1984 extends their "thank you" for a job well done along with good wishes and the best of luck for Marion on the occasion of her well deserved retirement. Mr. Wilson took Mr. Nathanson's seat at the Table.

95) On motion of Mr. Wilson, seconded by Mr. Hurlbert, at 1:35 P.M., it was unanimously VOTED that the Board resolve itself into a Committee of the Whole to discuss staff matters. Officers, directors, vice directors, and counsels, were asked to remain in the room; others departed.

96) The Committee of the Whole rose and reported to the Board at 1:48 P.M. The General Manager was asked to report to the Board concerning the status of a four-day workweek for a number of Headquarters personnel. The General Manager confirmed the five-day workweek had been implemented on the recommendation of the Management & Finance Committee. On motion of Mr. Holladay, seconded by Mr. Wilson, this action of the General Manager was approved and he was further directed to continue to examine alternatives which could accommodate the desires of employees while preserving to the membership the benefits of the five-day workweek. The Management and Finance Committee will continue to monitor this matter in consultation with the General Manager. Mr. Nathanson resumed his seat at the Table.

97) On motion of Mr. Stevens, seconded by Mr. Milius, it was unanimously VOTED that the Editor of QST regularly publish articles on current, proper operating techniques from experienced operators on net operation, general repeater participation, DX, CW, satellite operation, and other modes and methods as may be appropriate.

98) It was moved by Mr. Milius, seconded by Mr. Nathanson, that whereas it is extremely advantageous to display the ARRL diamond prominently to bring about expanded awareness of the League, therefore, it is moved that paragraph 3 of the Rules and Regulations Concerning ARRL Conventions is amended by the addition after the words, "an ARRL display booth or table" the following: "and shall make every effort to use the ARRL diamond prominently displayed on the front of all advertising and program materials." A roll call vote being required, the motion was ADOPTED with all directors voting in favor.

99) On motion of Mr. Butler, seconded by Mr. Wangler, it was VOTED that the Executive Committee, with the assistance of the General Manager, perform a study of networks in the amateur bands to determine the adequacy of current regulations to handle problems which may exist, or can be expected to arise, and report to the Board not later than the second Board Meeting of 1984.

100) It was moved by Mr. Holladay, seconded by Mr. Wangler, that the Forward Planning Committee is instructed to study the structure and responsibilities of Board committees, seeking comment from members of the Board; and is requested to submit its recommendations for improvements no later than 60 days prior to the 1985 Annual Meeting of the Board, with a progress report to be rendered at the Second 1984 Meeting. After discussion, on motion of Mr. Olson, seconded by Mr. Metzger, it was VOTED that the matter is laid on the Table.

101) On motion of Mr. Atkins, seconded by Mr. Price, the following resolution was unanimously ADOPTED:

WHEREAS, Noel B. Eaton, VE3CJ, a former ARRL Canadian Director and Vice-President, and President Emeritus of the International Amateur Radio Union, has a long and distinguished record of service to the American Radio Relay League and the world-wide amateur community, now, therefore,

BE IT RESOLVED that Noel B. Eaton is hereby elected a Director Emeritus of the American Radio Relay League. (Applause.)

102) On motion of Mr. Nathanson, seconded by Mr. Metzger, it was unanimously VOTED that Counsel is directed to seek such modification and/or waiver of Rule 97.112 as is necessary to permit operation of Headquarters station W1AW for general contacts by staff operators while on duty. Mr. Atkins abstained. Mr. Mendelsohn took Mr. Diehl's seat at the Table.

103) On motion of Mr. Mendelsohn, seconded by Mr. Sullivan, the following resolution was unanimously ADOPTED:

WHEREAS, for many years Douglas Edwards has donated his talents on behalf of amateur radio and,

WHEREAS, Mr. Edwards has given freely of his time without any form of compensation on the many projects that have been requested of him such as the recent memorial tribute to ARRL President Victor Clark, now, therefore

BE IT RESOLVED that the ARRL Board of Directors, assembled at Hartford, Connecticut, on this 27th day of March, 1984, does profoundly thank Mr. Edwards for his work on behalf of the League and Amateur Radio. Mr. Diehl resumed his seat at the Table.

104) On motion of Mr. Olson, seconded by Mr. Metzger, it was VOTED to lift from the Table the earlier motion concerning the study of Board committees by the Forward Planning Committee. On further motion of Mr. Olson, seconded by Mr. Grauer, it was VOTED that the motion be amended by striking the words "Forward Planning" and replacing them with "Executive." The vote then being on the motion as amended, the same was ADOPTED. Mr. Wilson took Mr. Nathanson's seat at the Table and Mr. Kanode took Mr. Milius's seat at the Table.

105) On motion of Mrs. Lewis, seconded by Mr. Stevens, it was unanimously VOTED that the Board thanks the code experts who assisted in the drafting of the

"Suggested Code Competition Guidelines" distributed at this meeting of the Board, and, to give the matter maximum consideration, they are requested to review the revised draft for a further report prior to the Second 1984 Meeting.

106) On motion of Mr. Stevens, seconded by Mr. Kanode, it was unanimously VOTED that the Board congratulates the staff on its recent efforts to improve the information made available to members who plan to operate overseas and the General Manager is encouraged to continue these efforts with the objective of having for each country an information packet with licensing information, application forms with English translation, local regulations and operating practices, and name, address, and telephone number of the IARU member society or other local contact.

107) On motion of Mr. Stevens, seconded by Mrs. Lewis, it was unanimously VOTED that the Board of Directors express its appreciation to Stephen Mendelsohn for the use of his computer and the word processing of Directors' motions during this Annual Meeting.

108) It was moved by Mr. Kanode, seconded by Mr. Stevens, that the ARRL staff be directed to adopt a Standard Operating Procedure for all of the six advisory committees and that such information be given to all present and future members. After discussion, on motion of Mr. Stevens, seconded by Mr. Wangler, it was VOTED that the matter is laid on the Table.

109) On motion of Mr. Carey, seconded by Mr. Wangler, it was unanimously VOTED that the General Manager and staff are congratulated for the improvement in the Document concept of the Board Meeting workbook and are requested to make continued improvements. (Applause.)

110) On motion of Mr. Butler, seconded by Mr. Sullivan, it was unanimously VOTED that the Membership Affairs Committee study the feasibility of having Section Affiliated Club Coordinators participate in the affiliation process of new applicants, study to what extent such participation may be desirable and report its findings to the Board of Directors on or before the Annual Meeting of 1985.

111) It was moved by Mr. Butler, seconded by Mr. Holladay, that the President be authorized to sign, on behalf of ARRL, the draft memorandum of understanding between ARRL and REACT International, Inc., developed in response to Minute 75 of the April 1983 Board Meeting. A roll call vote being requested, the motion was LOST 10 to 5, with Messrs. Butler, Diehl, Holladay, Sullivan, and Turnbull voting aye, and all other Directors voting nay with the exception of Mr. Atkins, who abstained. The Board was in recess from 3:05 until 3:25 P.M.

112) On motion of Mr. Butler, seconded by Mr. Holladay, it was unanimously VOTED to lift from the Table the earlier motion concerning the Standard Operating Procedures for advisory committees. On motion of Mr. Holladay, seconded by Mr. Sullivan, it was unanimously VOTED to strike the text and substitute therefor:

The ARRL Headquarters staff is directed to develop recommendations for a Standard Operating Procedure for all of the six advisory committees. After review and approval by the Membership Affairs Committee, this information shall be given to all present advisory committee members and to all future members. Whereupon, the motion was unanimously ADOPTED.

113) On motion of Mr. Holladay, seconded by Mr. Sullivan, it was unanimously VOTED that the Management and Finance Committee study the desirability and feasibility of ARRL Foundation administrative expenses being funded by the ARRL.

114) On motion of Mr. Holladay, seconded by Mr. Wangler, the following resolution was unanimously ADOPTED:

WHEREAS, the ARRL film "Amateur Radio's Newest Frontier" represents an excellent contribution to Amateur Radio public relations, and

WHEREAS, a very professional "Amateur" crew worked on the presentation, now, therefore,

BE IT RESOLVED that the Board of Directors, assembled at Hartford, Connecticut on this 27th day of March, 1984 thanks the following for their contributions to that effort:

Roy Neal, K6DUE
Alan Kaul, W6RCL
Bill Pasternak, WA6ITF
Frosty Oden, N6ENV
Peter O'Dell, KB1N
Dave Bell, W6AQ
George Barker, WB8PBC
Bob Brandon
S. Larry D'Anna, WA3KOK
Duane Dahlberg, WB6WMA
Art Donahue, KA1GGG
Gary Eldridge, KC8UD
Burt Hicks, WB6MQV
William Robison
Ron Sanford
Ed Cannady, WB6NSN
Gary Hendrickson, W3DTN
Phil Lawler
Steve Mendelsohn, WA2DHF
Bill Orenstein, KH6QX
Justine Schmidt
Arnold Chase, WA1RYZ
The Astronauts of STS-6, STS-7,
STS-8, and STS-9

115) On motion of Mr. Wangler, seconded by Mr. Holladay, it was unanimously VOTED that the General Manager is authorized to file, through Counsel,

comments in response to the Notice of Proposed Rule Making in Docket 84-265. Such comments shall state the League's support of the proposal to provide reimbursement of VEC's for out of pocket expenses incurred in amateur examination administration.

116) On motion of Mr. Wangler, seconded by Mr. Carey, it was unanimously VOTED that in view of the rapid developments in the field of Amateur Radio teleprinter communication, the editor of QST is encouraged to seek beginners' articles on current teleprinter techniques.

117) On motion of Mr. Atkins, seconded by Mr. Turnbull, it was unanimously VOTED that the Board adopts the cooperative agreement between the Quarter Century Wireless Association, Inc. and the American Radio Relay League, Inc. presented to the Board at this meeting. Mr. Milius resumed his seat at the Table.

118) On motion of Mr. Wilson, seconded by Mr. Hurlbert, it was unanimously VOTED that the staff is particularly commended for outstanding service in presenting the best side of Amateur Radio to the public during the recent Grenada crisis, and the flight of STS-9.

119) It was moved by Mr. Diehl, seconded by Mr. Grauer, that the Communications Department of the ARRL shall contact each area repeater frequency coordination group that is known to the League for the purpose of offering them a co-position with the local Official Observer in policing the spectrum above 30 MHz in accordance with the draft agreement between the FCC's Field Operations Bureau and ARRL. Those coordinators responding would be offered OO status. On motion of Mr. Holladay, seconded by Mrs. Lewis, it was unanimously VOTED that the matter is referred to the Membership Affairs Committee.

120) Turning now to agenda item 14, on motion of Mr. Holladay, seconded by Mr. Butler, it was unanimously VOTED that the General Manager is authorized to reimburse the Division Directors for actual expenses incurred by them during the year 1984 in the proper administration of ARRL affairs in their respective division, and in accordance with the Board policy, up to the amounts as follows:

Canadian	$ 9,500
Atlantic	11,000
Central	7,500
Dakota	3,800
Delta	10,000
Great Lakes	9,500
Hudson	5,600

Midwest	6,000
New England	8,500
Northwestern	13,000
Pacific	10,500
Roanoke	10,000
Rocky Mountain	5,250
Southeastern	9,000
Southwestern	9,000
West Gulf	7,000

Mr. Quiat took Mr. Carey's seat at the Table.

121) On motion of Mr. Stevens, seconded by Mr. Wangler, it was unanimously VOTED that the General Manager is hereby authorized to reimburse the following Committees, Task Groups, and Task Forces created by the Board for expenses incurred by them during the year 1984 in the proper execution of their duties, and in accordance with Board policy, as follows:

Ad Hoc Committee on Washington Presence	$2,000
Ad Hoc Committee on Strengthening of CRRL	6,000
Ad Hoc Committee on Monitoring	5,000
Ad Hoc Committee on Computer Based Message Systems	3,000
RFI Task Group	4,000
Committee on the Biological Effects of RF Energy	3,500
Committee on Amateur Radio Digital Communication	9,000

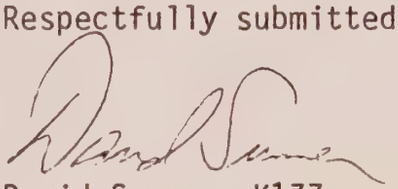
122) On motion of Mr. Stevens, seconded by Mr. Metzger, it was unanimously VOTED that, to continue the Board's policy of reimbursing QSL bureau managers of the League for certain travel in furthering ARRL organizational objectives, the General Manager is hereby authorized to pay during the year 1984 a total amount not to exceed $4000 under terms prescribed by the general pattern established by the Board. Mr. Carey resumed his seat at the Table.

123) On motion of Mr. Atkins, seconded by Mr. Sullivan, it was VOTED that, to continue the Board's policy of reimbursing National Traffic System officials above the section level for certain approved expenses in furthering ARRL organizational activities, the General Manager is authorized to pay during the year 1984 a total amount not to exceed $16,000 under terms prescribed by the Communications Manager following the general pattern established by the Board.

124) Turning to agenda item 15, the Board considered the dates for the second meeting of 1984 and the annual meeting of 1985. On motion of Mr. Carey, seconded by Mr. Stevens, it was unanimously VOTED that the Second 1984 Meeting of the Board will be held in Hartford on October 25 and 26. On motion of Mr. Carey, seconded by Mr. Butler, it was unanimously VOTED that the tentative dates for the 1985 Annual Meeting of the Board are March 21 and 22. During the course of these motions Messrs. Wangler, Nathanson and Hippisley departed the meeting. Mr. Wilson took the seat at the table representing the Great Lakes Division.

125) There followed an opportunity for all present to make final comments, during the course of which Mr. Gibson took Mrs. Lewis's seat at the table. There being no further business, the Board adjourned sine die at 4:35 P.M. Total time in session as a Board: 12 hours, 23 minutes; as a Committee of the Whole: 2 hours, 47 minutes; total direct authorizations: $194,650.

Respectfully submitted,



David Sumner, K1ZZ
Secretary

FOR PAUL RINALDO - DRAFT

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Rules Governing	)	
the Amateur Radio Service to	)	RM-
Permit Automatic Control of	)	
Amateur Digital Communications	)	

PETITION FOR RULE MAKING

The American Radio Relay League, Incorporated (the "League"), the national association of amateur radio operators licensed by the Commission, hereby respectfully requests that the Commission amend its rules by the addition of a new Section 97.80 to permit automatic control of digital communications on all amateur frequencies, provided that certain safeguards are incorporated in the amateur station as control functions. As support for this request, the League states as follows:

1. Present Commission Rules at Section 97.79 provide (a) the licensee of an amateur station shall be responsible for its proper operation; and (b) every amateur radio station, when in operation, shall have a control operator. "The control operator shall be present at a control point of the station except when the station is operated under automatic control. (Automatic control is only permitted where specifically authorized by the Rules of this part)..." There are provisions[1/] for automatic

1/ See Section 97.85(e) regarding automatic control of repeater operation and Section 97.86 regarding automatic control of a station in auxiliary operation when part of a system of stations in repeater operation is operated under automatic control.

operations of repeater and auxiliary stations, but there is no such provision for routine amateur communications utilizing digital codes under automatic control.

2. There are now in place at Section 97.69 of the Rules detailed provisions for use of digital communications in the Amateur Radio Service. That section specifies, in part, that

> These digital codes may be used for such communications as (but not limited to) radio teleprinter and other objects, transference of computer programs or direct computer to computer communications, and communications in various types of data networks (including so-called "packet switching" systems);...

These types of digital communications, especially since the advent of request-repeat radioteleprinter systems such as AMTOR,[2/] can be done with a great deal of reliability without a control operator present. Amateur stations, utilizing present microprocessor and computer technology now routinely present at amateur stations, can automatically transmit and receive digital communications, verify receipt of messages, and respond when inquired of. The use of Computer Based Message Systems is a new aspect of amateur communications which should be encouraged, consistent with establishment of standards for good amateur operating practice. Consistent with procedural safeguards to present malfunctions from continuing during unattended automatic operations of

2/ See Order, RM-4122, FCC 83-36, 53 RR 2d 109 (1983), permitting the use of AMTOR in the Amateur Radio Service.

amateur stations, the level of amateur experimentation with digital communications has progressed to the point that automatic control of digital communications is both feasible and necessary to facilitate further development of such experimentation.

3. Therefore, the League requests that a new Section 97.80 be established, immediately following the control operator requirements of Sections 97.79 in Subpart D of the Rules governing Operating Requirements and Procedures, to permit automatic control of an amateur station when utilizing digital communications as defined by and in accordance with Section 97.69 of the Rules. Such automatic operation would be subject to the inclusion of adequate circuitry to assure (1) the detection of transmitter malfunction and, upon detection thereof, automatic transmitter shutoff; (2) the capacity to prevent transmission of improper message traffic, such as business communications; and (3) compliance with all other applicable technical and operational standards for amateur radio stations.

4. Of course, the authority to utilize automatic control of digital communication would not alter the primary responsibility of the station licensee for proper station operation. The League Board of Directors has adopted interim standards for good amateur practice for digital communications, and specifically for establishment and operation of computer-based message systems in the Amateur Radio Service. The promulgation of such guidelines

will assist in assuring responsible use of the automatic control sought by this Petition. They are as follows:

Establishment of New Systems

New CBMSs should serve a need within the basis and purpose of Amateur Radio as stated in Section 97.1 of the FCC rules and not simply add to congestion by duplicating services already available.

Frequencies should be selected in accordance with the ARRL band plans.

VHF and UHF channels should be coordinated with the appropriate frequency coordinator(s).

Frequencies in the HF bands should be time-shared with existing CBMSs to the extent possible in coordination with the other CBMS operators using that same frequency.

Where sharing of an existing frequency is not feasible, new channels should be selected near the upper portion of the particular RTTY subband, leaving the lower parts of the RTTY subband to DX and other operator-to-operator QSOs.

Operational Safeguards

CBMSs should listen before transmitting. The system should sense activity on the channel and not transmit until the channel goes free. This can be accomplished by a carrier-detect circuit.

Incoming messages should not be retransmitted until read and released by the CBMS operator.

Until such time that the FCC permits unattended automatic operation of HF CBMSs, CBMS operators should monitor their transmissions (at least aurally) at all times that the CBMS is on the air and have a reliable method of terminating transmission in the event of malfunction. Monitoring may be done from a remote location.

The system should have software provisions to limit specific responses to a maximum of 10 minutes. Longer responses should be interrupted at least every 10 minutes for a go-ahead from the other station.

The system should have a hardware "watchdog" timer to limit individual transmissions to 10 minutes.

In order to make the channel available to other stations, CBMS operators should cull files that are out of date and offer user instructions for an s.a.s.e. by mail.

A CBMS operator should establish and make public a policy regarding acceptance of borderline traffic such as that relating to sale of equipment after reviewing current FCC rules and interpretations.

User Operating Practices

Monitor the frequency for a short period before calling a CBMS.

Do not interrupt another station using a CBMS.

Do not interfere with a QSO on or near the frequency.

Always properly identify your station.

Keep your signals on frequency.

Do not list "for sale" items without prior permission of the CBMS operator.

Make sure that you deactivate the CBMS by using that system's correct EXIT command.

5. The Commission has twice[3/] recently emphasized its objective of encouragaing new technologies in the Amateur Service, balanced against assuring enforcement capability. In this context, enforcement problems are created by the proposed rule change. Yet, the added authority would greatly facilitate and encourage amateur digital experimentation and increase communications effectiveness.

3/ See Order, FCC 83-36, 48 Fed. Reg. 7457, 53 RR 2d 109 (1983) and Report and Order, "Digital Code Usage in the Amateur Radio Service," FCC 82-413, 52 RR 2d 397 (1982).

WHEREFORE, the foregoing considered, the American Radio Relay League, Incorporated respectfully requests that the Commission amend its Rules by the addition of the proposed Section 97.80, attached as Appendix A, to permit automatic control of digital communications in the Amateur Radio Service, subject to the operational safeguards specified therein to assure rule compliance and preclude interference.

Respectfully submitted,

225 Main Street
Newington, CT 06111

THE AMERICAN RADIO RELAY LEAGUE, INCORPORATED

By: _____
Christopher D. Imlay,
Its Counsel

Booth & Freret
1302 18th Street, N.W.
Washington, D.C. 20036
(202) 296-9100

APPENDIX

Section 97.80 Automatic Control of Digital Communications.

Amateur Radio Stations may be operated under automatic control when utilizing digital communications pursuant to Section 97.69, provided that the control functions include (i) adequate provision for detection of transmitter malfunction and discontinuance of transmitter operation in the event such malfunction is detected; (ii) the capacity to preclude transmission of improper messages; and (iii) adequate provision to assure compliance with all other applicable technical and operational rules contained in this part.

9531 Odlin Road,
Richmond, B.C. V6X 1E1
April 2, 1984

Mr. Paul Rinaldo, W4RI
American Radio Relay League
225 Main Street
Newington, CT 06111

Dear Paul:

I have been reading the information you have been sending me regarding the increasing problems with MSO operation, particularly in the 20 Metre band. Your letter to Mr. Bill Snyder referred to a complaint received from a group of Canadians objecting to RTTY operation above 14100 kHz. I don't know what the substance of this complaint was but I have been meaning to write you about my own concerns for some time.

As you may know, for as long as I have been an Amateur there has been a gentleman's agreement in the western hemisphere that digital modes of transmission would take place below 14100 kHz. In 1957, when I got my ticket, U.S. phone operation was between 14200 and 14300 kHz. leaving 14100 to 14200 and 14300 to 14350 kHz. for Canadian, Carribean and Latin American phone operation. Later, the U.S. expanded its phone operation by 50 kHz. to include the 14300 to 14350 kHz. segment which only left the area between 14100 and 14200 kHz available for non-U.S. phone operation.

The usage of this 14100 to 14200 segment was determined by another gentleman's agreement which was basically that Spanish-speaking stations would use the lower part of this segment and English-speaking stations would use the upper part of this segment. Most of the important Spanish nets operate just above 14100 kHz. Signals from Latin-America are frequently extremely strong in Canada and vice-versa. The gentleman's agreement was necessary because of the language differences leading to confusion as to who was the rightful user of a frequency.

Still later, the U.S. again expanded its phone operation down to 14150 kHz. and now leaves only 14100 to 14150 kHz for non-U.S. phone operation. This has basically caused Canadian phone operations to be lowered so that now they overlap some of the South American and Latin-American operation and has led to some frequency fights and QRM caused to some of the important Spanish-speaking nets. South American QRM has frequently been a problem here in Canada now that only 50 kHz. is left.

And now with CW operation encroaching into the lower part of this 50 kHz. segment, considerable interference is being caused to the Latin American nets and phone operations and to the English-speaking phone operations. The gentleman's agreement now is almost unworkable and things are starting to get chaotic.

The adoption of a band-plan which puts MSOs and RTTY operation into the bottom 40% of this 50 kHz segment would only leave 30 kHz. for exclusive use of non-U.S. phone in the western hemisphere and cause disruption of all the Latin American nets and considerable QRM problems between North and South America. These problems can be severe because most of the operators involved are unilingual.

Remember that the non-U.S. phone segment has been reduced successively from 150 kHz. to 100 kHz to 50 kHz and now possibly to 30 kHz. This segment has always been the victim of U.S. phone privilege expansion and now appears to be under attack again.

If more space is required for MSOs and RTTY, why not take back the last 50 kHz. expansion of the U.S. phone portion and then allow the 50 kHz. non-U.S. phone segment to move up 50 kHz. which would allow expanded RTTY operation above 14100 kHz? I am not handing this out as a serious suggestion because I don't think it would be popular in the U.S. The FCC giveth but never taketh away.

As you know, I understand the problem any new mode of operation has getting a place to operate. All the other modes have their segments and no one mode wants to give up part of its space to some new upstart. My area of concern is why does it have to always be the same segment that loses out each time? Although the same argument could have been given each time the space was reduced, I really feel that the non-U.S. phone segment should not be encroached upon any more.

I am not argueing this point from a legal perspective nor from a philosophical one. I am just stating the fact that this suggested band plan would cause serious disruption and problems and would also be a blow against international cooperation.

Also note that Canadian regulations do not permit RTTY operation (F1) above 14100 kHz.

It seems to me that Amateurs operating in a particular mode or style like CW, RTTY, SSB, VHF-FM, DX, ragchew, public service, etc. look at the situation from that narrow perspective and that appears to be the situation here. The problem is interference in the 14070 to 14100 kHz. segment but the solution proposed would

generate even more severe problems outside of this segment. It may well be better to leave these chaotic conditions as they are rather than to compound the problem by interfering with the gentleman's agreement above 14100 kHz. At the very least, other options should be evaluated! I hope that any decisions in this area are not made from the narrow perspective of looking only at the usage made of 20 Metres by U.S. Amateurs.

I hope that this will help balance the input you have received and maybe we can discuss it at the forthcoming Committee meeting. I am looking forward to seeing you in Trenton.

Yours truly and 73,

Douglas Lockhart

Douglas Lockhart, VE7APU

MAIDENHEAD SQUARES

A WORLDWIDE LOCATOR SYSTEM

N. A. S. FITCH, G3FPK

CONTESTS have always been a feature of amateur radio activity and few weekends are free of them on the HF and VHF bands. On the HF bands, the scoring is usually based upon countries, prefixes, or zones of various kinds worked. Conversely, most all VHF/UHF/SHF events use distance as the basis for calculating the points. Furthermore, distance records are compiled for contacts on the many bands above 30 MHz *via* various propagation modes such as Moonbounce, Sporadic E, tropospheric, etc. To calculate distances over the Earth's surface, and the Great Circle bearing of one station from another, if required, information must be exchanged to, in effect, define latitude and longitude.

Latitude and Longitude

Everyone is familiar with the concept of latitude and longitude whereby a sphere, such as the Earth or Moon, is divided into *Meridians of Longitude* running north to south through the poles, and *Parallels of Latitude* parallel to the Equator. Any spot on the sphere's surface can be uniquely defined by the degrees, minutes and seconds method to an accuracy of about ±15½ metres at the Earth's Equator. Knowing the latitude and longitude of any two locations, the actual surface distance between them can be calculated by solving the triangle OAB in Fig. 1. OA and OB represent the radius of the Earth, while AB can be found when the angle AOB has been found. The latter is calculated from the formula:—

$$\angle AOB = \arccos[(\sin a \times \sin b) + (\cos a \times \cos b \times \cos C)] \ldots (1)$$

where:— a = the latitude of location A
b = the latitude of location B
C = the longitude difference between A and B.

Notes:— *1.* arcos is the same as $\cos^{-1}$ and means, "the angle whose cosine is . . ."

2. Latitudes south of the equator must be entered with a minus sign. *e.g.* 39°S would be entered as "−30" with due allowance made for the sign of the appropriate function. (If using a pocket calculator, this is done automatically).

Other Reference Systems

In Great Britain, the *Ordnance Survey* uses a basic grid system of 100 km. by 100 km. squares identified by two letters, such as "TQ" which includes the Greater London region, and "NS" in which Glasgow is situated. Places are located by their *National Grid Reference* (*NGR*) consisting of two letters and six figures, *e.g.* TQ 694683. The first three figures are known as *eastings* as they are measured from the western edge of the main 100 km. squares in an easterly direction, while the last three are called *northings* since they are measured from the southern edge of these squares in a northerly direction. Thus, the first and fourth figures represent tens of kilometres, the second and fifth kilometres, and the third and sixth hundreds of metres.

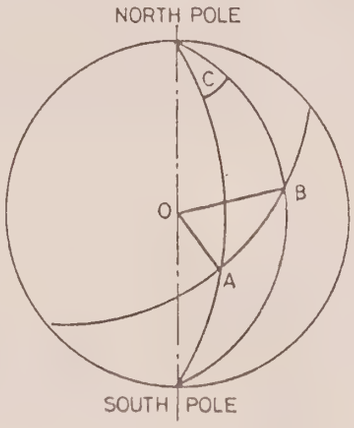


Fig. 1 E 174

Fig. 1. Point O is the centre of the Earth. Points A and B lie on three great circles, two of which pass through the poles; *i.e.* they are meridians of longitude. Angle C represents the difference in longitude between A and B. To calculate the circumferential distance from A to B, the angle AOB has to be calculated. *See* text.

For amateur radio purposes, the NGR system is too parochial. It is quite satisfactory for calculating the distance from Land's End to John o'Groats, but no use for working out the short distance from Dover to Calais since the NGR system does not extend into France. It will be seen that the NGR system is incompatible with latitude and longitude.

A concept familiar to all serious VHF operators in Europe is the *QTH Locator Squares* system and which, unlike the NGR one, *is* derived directly from latitude and longitude. The *primary squares* are two degrees from east to west and one degree from north to

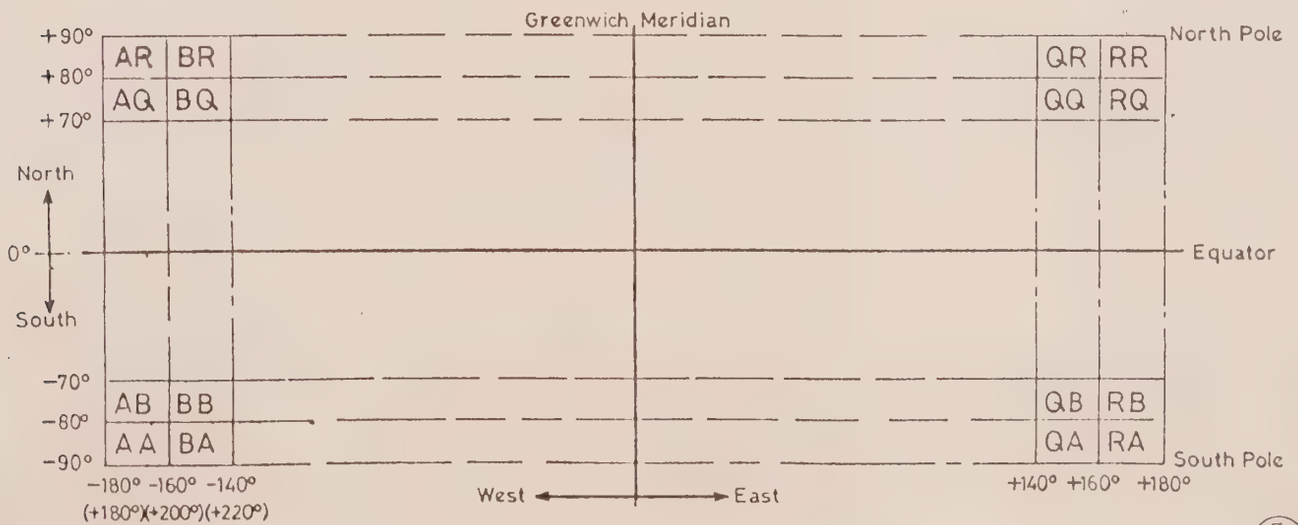


Fig. 2 THE 324 FIELDS E 175

Fig. 2. The 324 Fields. Note the west to east, and south to north lettering sequences. *See* text for explanation of the +180°, +200° figures.

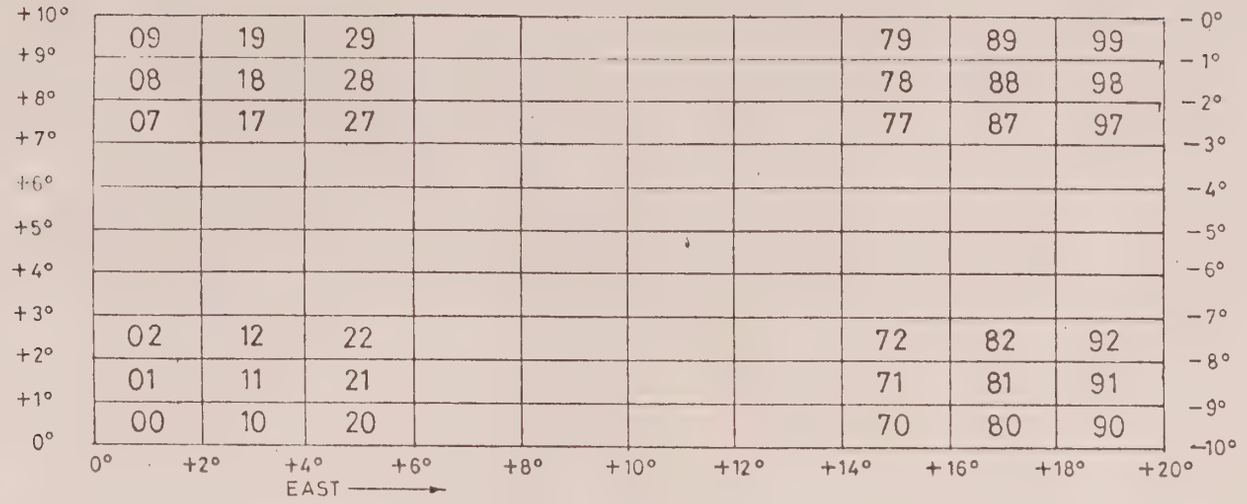


Fig. 3. The 100 Squares. Note the west to east, and south to north numbering sequence. For the northern hemisphere use the left-hand, plus, scale and for the southern hemisphere use the right-hand, minus, scale. *See* text.

south, being identified by two letters such as "AK" or "CG". These are sub-divided into eighty *secondary squares,* twelve minutes east to west and 7½ minutes north to south, numbered 01 to 80. Each of these is finally sub-divided into nine *tertiary squares* lettered "a" and "j" omitting "i." Thus a typical locator would be ZN54c.

Actually the so-called squares are not square since the "sides" converge towards the North Pole. At latitude 51°N, the tertiary squares are 4.662 kms. East-West and 4.631 kms. North-South giving a diagonal accuracy of ±3.286 kms. within a square. The origin of the European QTH Locator System, square "AA," is the Greenwich Meridian at latitude 40°N. Unfortunately, this ingenious system is not unique. For example, the Mediterranean island of Malta is in "HV" square, but there is another "HV" in Sweden and others in Asia.

Maidenhead Squares

Some VHF enthusiasts saw the need for a world locator system that would define any location with reasonable accuracy in as few symbols as possible. During the 1970s, over twenty schemes were proposed and these were studied at a meeting of European VHF Managers in Maidenhead, Berkshire on April 26-27, 1980. Out of these deliberations there emerged the preferred system from a proposal by John Morris, G4ANB. This *Maidenhead Squares* idea now seems to have been adopted by Moonbounce operators throughout the world.

This system is based upon latitude and longitude, the globe being divided into 324 areas, each twenty degrees from east to west and ten degrees from north to south, known as *Fields,* and identified by two letters from "AA" through to "RR". The fields are each divided into one hundred *Squares* two degrees E-W and one degree N-S and numbered from "00" to "99." Thus these squares are compatible with the primary squares of the QTH Locator system, currently in use in IARU Region 1. The squares are finally sub-divided into *Sub-squares,* each five minutes E-W and two-and-one-half minutes N-S. These 576 sub-squares are lettered from "AA" through to "XX". So a complete locator would be of the form JN45WH, for example, and that would be unique and not repetitive. The accuracy is similar to that of the current five symbol QTHL system. In each, the "height" of the smallest squares is the same, but in the Maidenhead system they are 25% "wider." At latitude 51°N, the sub-squares are 5.828 kms. E-W, giving a diagonal accuracy of ±3.722 kms.

The origin of the Maidenhead system is longitude 180° West at the South Pole. All lettering/numbering runs from west to east and from south to north, and the basic idea can be seen by studying Figs. 2, 3 and 4. Referring to the JN45WH example, it will be seen that the 1st, 3rd, and 5th characters, "J," "4" and "W" represent the longitude information, and the 2nd, 4th and 6th characters, "N," "5" and "H" the latitude data.

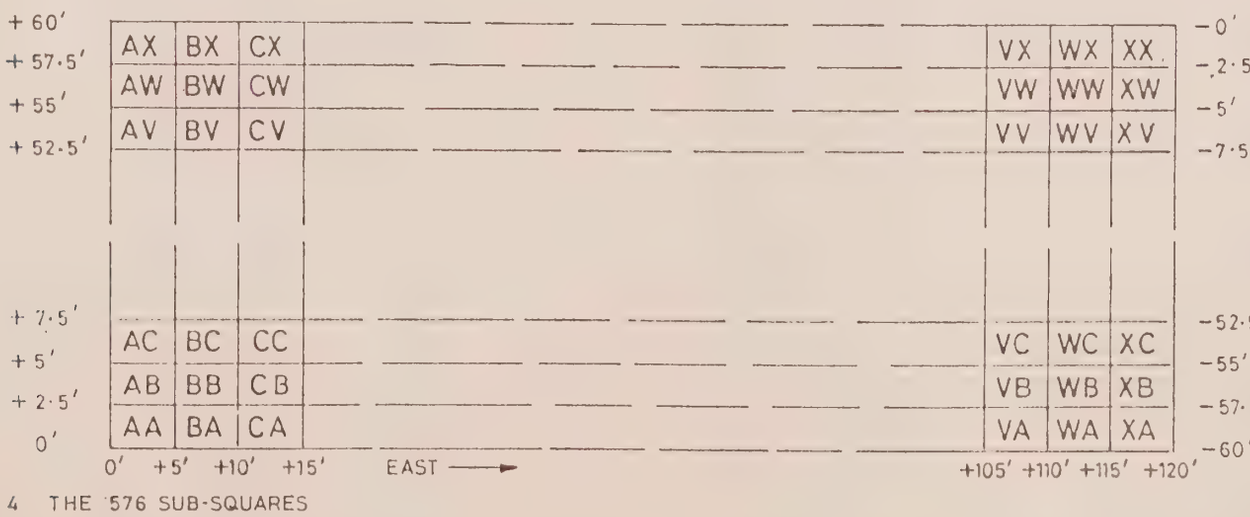


Fig. 4. The 576 Sub-squares. Note the west to east, and south to north lettering sequences. For the northern hemisphere use the left-hand, plus, scale and for the southern hemisphere use the right-hand, minus, scale. *See* text.

Working out a World Locator

The best way to appreciate the Maidenhead *World Locator System* is to mark the Fields on a large world map, preferably one drawn in *Mercator's* projection. If you do not wish to do this, you can draw them on a sheet of tracing paper hinged to the top of the map with adhesive tape. To work out any locator, the latitude and longitude must be known. Tables 1 and 2 have been compiled to enable anyone to work out a World Locator from such data. A couple of examples should suffice to illustrate the use of these tables.

Example 1. Derive the locator for Scafell mountain in the English Lake District.

From the *Ordnance Survey*, the latitude is derived as North 54°.26′. 50″ and the longitude West 3°.13′. 23″. To avoid ambiguity, longitudes *west* of Greenwich round to the International Date Line are changed to *east* of Greenwich, using the formula:— Long. E° = 360° — Long W°. Thus Scafell's longitude is 360—3°.13′ .23″ = 356°.46′ .37″ East. This kind of presentation will be familiar to satellite users, although in *amateur* satellite work for some strange reason, degrees *west* of the Greenwich Meridian are used!

Back to Scafell, though. Using Table 1a, we note that 356° lies in the "340-360" line corresponding to letter "I", to give the first character. Coming to Table 1b, measuring from the western edge of the Field, *i.e.* 340°, we have 16°.46′. 23″ left over, which figure lies within the "16-18" line corresponding to figure "8" to provide the third character. Finally to Table 1c, again measuring from the western edge of the square, we have 46′. 23″ left over, which amount lies within the "45-50" line, equating to the letter "J". So we now have I?8?J? for the longitude part.

Degrees East of Greenwich	*Field Letter*
0- 20	J
20- 40	K
40- 60	L
60- 80	M
80-100	N
100-120	O
120-140	P
140-160	Q
160-180	R
180-200	A
200-220	B
220-240	C
240-260	D
260-280	E
280-300	F
300-320	G
320-340	H
340-360	I

Table 1a. This determines the first character. *Note:* **Longitudes west of Greenwich have to be converted to degrees east.** *See* **text.**

Degrees East of western side of field	*Square Figure*
0- 2	0
2- 4	1
4- 6	2
6- 8	3
8-10	4
10-12	5
12-14	6
14-16	7
16-18	8
18-20	9

Table 1b. This determines the third character.

Minutes East of western side of square	*Sub-square Letter*
0- 5	A
5- 10	B
10- 15	C
15- 20	D
20- 25	E
25- 30	F
30- 35	G
35- 40	H
40- 45	I
45- 50	J
50- 55	K
55- 60	L
60- 65	M
65- 70	N
70- 75	O
75- 80	P
80- 85	Q
85- 90	R
90- 95	S
95-100	T
100-105	U
105-110	V
110-115	W
115-120	X

Table 1c. This determines the fifth character.

Table 1. Longitude Data

To derive the latitude characters, we use Table 2. In Table 2a, 54°N is in the "+50-60" row, to give the second character, the letter "O." Measuring from the southern edge of the Field, we have 4°.26′ 50″ left over, which lies in the "+4-5" row in Table 2b, to give figure "4". Lastly, the remaining 26′. 50″ is found in the "+25-27.5" row in Table 2c, corresponding to the letter "K". Therefore, the complete locator for Scafell becomes I0 84 JK.

Example 2. To find the locator for a place in the southern hemisphere to the east of the Greenwich Meridian, *e.g.* 32°.21′.18″ South and 28°.44′. 39″ East in Cape Province, South Africa. Following the same procedure as in Example 1, from Table 1a we derive the first character "K" from the "20-40" line. There is 8°.44′. 39″ left over which yields figure "4" from line "8-10" in Table 1b, for the third character. From Table 1c, with 44′. 39″ left over, from line "40-45" we get the fifth character, the letter "I".

Next the latitude data from Table 2. Since we are dealing with a southern hemisphere location, the "minus" parts of these tables will be used. From 2a, the 32°S part is in line "—30 —40" corresponding to letter "F" for the second character. There is 2°21′.18″ over and from 2b, this lies in line "—2 —3", using the right-hand column and gives figure "7". Turning to 2c, we still have 21′. 18″ over and, again using the right-hand column, this lies in line "—20 —22.5" corresponding to letter "P" for the sixth character. This gives the complete locator as KF 47 IP.

Naturally Tables 1 and 2 can be used in reverse to calculate the latitude and longitude, given the locator code. To take an example, let us derive the latitude and longitude corresponding to OJ 11 VH.

The longitude data is given by the 1st, 3rd and 5th characters, "O", "1" and "V". From Table 1a, the letter "O" corresponds to 100°E; remember, always work from the *western* edge. From 1b, figure "1" corresponds to 2° and from 1c, the letter "V" is in

the "105-110" minutes line. Let us take the mid-point of that sub-square as 107.5′ or 1°.47.5′. So the longitude is the sum of these three figures:—

O = 100°
I = 2°
V = 1°.47.5′
Longitude = 103°.47.5′

The latitude information is contained in the 2nd, 4th and 6th characters, "J", "1" and "H". From Table 2a, "J" is in row "+0 −10" so we start with 0°. From 2b, the figure "1" is in row "+1 −2" since we have established from the "J" letter that the location is a plus one, *i.e.* in the *northern* hemisphere. This gives 1°. Lastly, from 2c, the "H" is in the "+17.5 −20" row, so the mean figure is 18.75′. Thus the latitude is:—

J = 0°
1 = 1°
H = 0°.18.75′
Latitude = 1°.18.75′

This location is in the region of Singapore, in south-east Asia.

Distance Calculations

The distance between two locations on the surface of a sphere can be derived from Equation (1) which gives the angle between the two locations as viewed from the centre of the globe. The Earth is not a perfect sphere, its polar diameter being about 0.34% less than its equatorial diameter. The author uses figures of 6,356.912 and 6,378.388 kms. for the respective *radii*. Therefore, the average circumference of the Earth is:—

(6,356.912 + 6,378.388) × π kilometres

which works out to 40,009.125. Thus, for every one degree of angle subtended at the centre (point "O" in Fig. 1) the surface distance is 40,009.125 ÷ 360 = 111.13646 kms. So to work out the distance between "A" and "B" just multiply the solution to Equation (1) by this constant.

Latitude Degrees	*Field Letter*
+80-90	R
+70-80	Q
+60-70	P
+50-60	O
+40-50	N
+30-40	M
+20-30	L
+10-20	K
+ 0-10	J
− 0-10	I
−10-20	H
−20-30	G
−30-40	F
−40-50	E
−50-60	D
−60-70	C
−70-80	B
−80-90	A

Table 2a. This determines the second character. The plus sign denotes northerly latitudes, the minus sign southerly ones.

Degrees North	*Square Number*	*Degrees South*
+9-10	9	−0- 1
+8- 9	8	−1- 2
+7- 8	7	−2- 3
+6- 7	6	−3- 4
+5- 6	5	−4- 5
+4- 5	4	−5- 6
+3- 4	3	−6- 7
+2- 3	2	−7- 8
+1- 2	1	−8- 9
+0- 1	0	−9-10

Table 2b. This determines the fourth character. Use the left-hand column for latitudes north of the Equator, and the right-hand column for those south. *See* text.

Minutes North	*Sub-square Letter*	*Minutes South*
+57.5 - 60	X	− 0 - 2.5
+55 - 57.5	W	− 2.5 - 5
+52.5 - 55	V	− 5 - 7.5
+50 - 52.5	U	− 7.5 - 10
+47.5 - 50	T	−10 - 12.5
+45 - 47.5	S	−12.5 - 15
+42.5 - 45	R	−15 - 17.5
+40 - 42.5	Q	−17.5 - 20
+37.5 - 40	P	−20 - 22.5
+35 - 37.5	O	−22.5 - 25
+32.5 - 35	N	−25 - 27.5
+30 - 32.5	M	−27.5 - 30
+27.5 - 30	L	−30 - 32.5
+25 - 27.5	K	−32.5 - 35
+22.5 - 25	J	−35 - 37.5
+20 - 22.5	I	−37.5 - 40
+17.5 - 20	H	−40 - 42.5
+15 - 17.5	G	−42.5 - 45
+12.5 - 15	F	−45 - 47.5
+10 - 12.5	E	−47.5 - 50
+ 7.5 - 10	D	−50 - 52.5
+ 5 - 7.5	C	−52.5 - 55
+ 2.5 - 5	B	−55 - 57.5
+ 0 - 2.5	A	−57.5 - 60

Table 2c. This determines the sixth character. Use the left-hand column for latitudes north of the Equator, and the right-hand column for those south. *See* text.

Table 2. Latitude Data

Accuracy

Making the perfect sphere assumption, all Fields, Squares and Sub-squares are the same distance from north to south so, for any two locations on the same longitude — say West London and Accra in Ghana — the accuracy is ± 4.631 kms., the "height" of a sub-square. However, in the E-W direction the size of the sub-squares is a maximum at the Equator and zero at the Poles. Using the average circumstance of 40,009.125 kms., the 5′ width equates to 9.261 kms. so the maximum error between two points on the Equator would be ± 9.261 kms. The maximum error would occur between two sub-squares straddling the Equator, *e.g.* KJ 80 AA and KI 89 BX, being ± 10.355 kms. However, in such cases, local maps would be used for working out short distances.

A New Award?

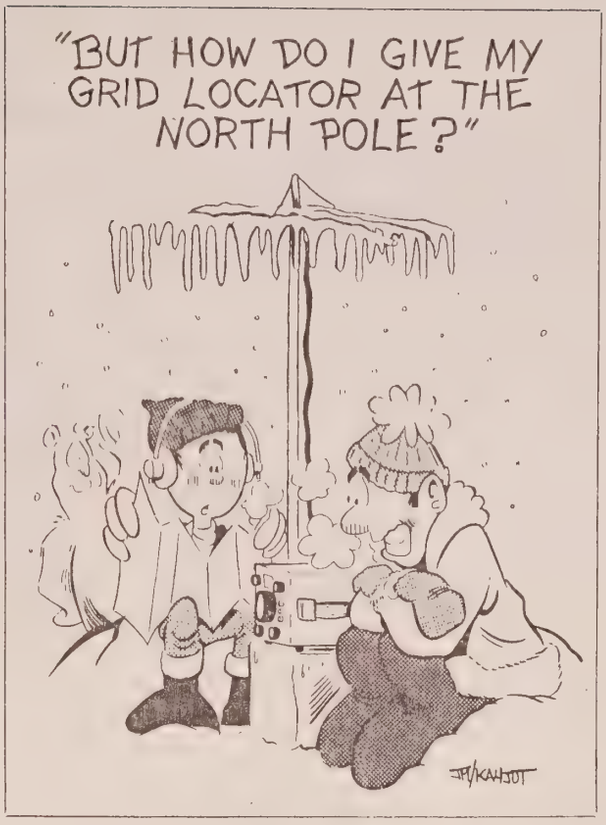
For certificate hunters, one can envisage a new award based upon a "Worked All Fields" concept. The attraction of this is that it would eliminate any argument about what constitutes a country. The only requirement would be the obvious one that whoever was operating from wherever had a valid licence to do so, in accordance with I.T.U. regulations. This would avoid tragedies like the ill-fated Spratly Islands affair since there would be no need to visit such sensitive areas. The *Short Wave Magazine's* QTH Squares Century Club, and the QTH Squares Table in the

VHF Bands feature leave little doubt of the popularity of an impartial "squares" idea, so why not extend it to a global scale? Any such award could become "big business," as has the ARRL's DXCC, so it would need to be sponsored and managed by a large organisation. Since the idea for the described world locator system was born in England, it would be appropriate if the RSGB operated such an awards programme.

Conclusion

The QTH Locator system which has been in use in part of I.A.R.U. Region 1 for many years, while being basically satisfactory, does have the drawback of not being unique. It is not suitable for inter-continental use. Whether or not it is eventually phased out in favour of the Maidenhead Squares system for VHF contest use is up to the VHF fraternity to decide. However, with more long distance contacts being made in the VHF/UHF/SHF bands, *via* Moonbounce, Transequatorial propagation, satellites, etc., there is no harm in including your World Locator code on your QSL card.

VHF/UHF Century Club Awards



thanks to OH5YW and *Radioamatoori*

It's all about collecting grid squares, the new VHF cousin of DXCC. And determining your locator is a piece of cake!

By John F. Lindholm,* W1XX

If you live in Virginia Beach, Virginia, you are on exclusive FM26 real estate; the rest lies under the Atlantic Ocean. If you live in the farthest northwest reaches of Washington state, your CN78 designator will make you very popular on the vhf bands. Should you be vacationing next summer at the Cape Cod National Seashore, don't plan on relaxing at Nauset Beach: 'You'll be pestered constantly on 50 MHz for your rare FN51 exchange. And those of you who live in southern California and have always dreamed of going on a DXpedition, turn your gaze on San Clemente Island. The southern half of this tiny land mass in the Santa Barbara Channel is the sole foothold in DMØ2. A new series of prefixes? Nope. FM26, CN78, FN51 and DMØ2 are grid squares!

That's right. All those funny designators are grid-square locators. Though they may sound funny now, they may not be all that strange after you start hearing them used as standard QSO exchanges above 50 MHz. So, if you thought the 20-meter DX pileups on FB8WG, Spratley, or 1AØKM were bad, you ain't heard nothing yet. Wait till there is a 6-meter E-skip operation from Burrwood, Louisiana (EL58), at the *extreme* southernmost point of the Mississippi River delta. The bands will go crazy!

Why all the excitement? Because confirming contact with 100 2° × 1° grid squares above 50 MHz will earn you membership in the exclusive *Century Club* — not the popular DX Century Club, but its new vhf counterpart, the VHF/UHF Century Club, or VUCC. It's here: The brand-new ARRL-sponsored achievement award for working grid squares measuring 2° longitude by 1° latitude on frequencies above 50 MHz begins January 1, 1983. The ARRL Ad Hoc Committee, which has been studying ways of promoting vhf/uhf activities, has enthusiastically recommended this program to further boost activity on the higher frequencies.

Individual awards will be issued *per band,* with initial qualifying levels as follows: 50 MHz — 100; 144 MHz — 100; 220 MHz — 50; 432 MHz — 50; 902 MHz (when available) — 25; 1296 MHz — 25. Each award will be endorsable in increments of 25 for 50 and 144 MHz, 10 for 220 and 432 MHz, and 5 for 902 and 1296 MHz. Those certificates offered for 220 and 432 MHz will indicate membership in the *Half* Century Club. For higher frequencies, the *Quarter* Century Club will appropriate. But only those contacts made on January 1, 1983 and after will count for VUCC credit. Recognition for microwave activity above 1296 MHz is under active consideration, with qualifying levels to be instituted in the near future retroactive to the same starting date.

How to Determine Your Grid Square

To exchange grid-square information, you must first identify your own grid square. That is the easy part. Your 2° × 1° grid locator, measuring approximately 100 miles by 70 miles, is indicated by just two letters (the field) and two numbers (the square).[1] For most North Americans, the first two characters of your locator designation can be read directly from the map (see Table 1). For the third and fourth character numerals, simply convert your longitude and latitude (consult any road atlas or topographic map) as indicated in Table 1. This grid locator has worldwide application. It is the so-called "Maidenhead Locator System," named after the village outside London where the European vhf managers met in 1980 to endorse a replacement for the present European "QTH Locator." This system was introduced in West Germany some 30 years ago and spread like wildfire throughout Europe and North Africa. Originally conceived for European use, it has outgrown its geographical host and is unsuitable for worldwide application. Thus, the Maidenhead System, applicable throughout the globe and recently approved for use in the Far East at the Region 3 IARU conference held in Manila, appears at just the right time.

Collecting grid squares became quite popular throughout Europe, as impressive totals were amassed by vhf/uhf enthusiasts on the continent. Grid totals are published regularly within each country. "Gridpeditions" (if that term catches on, remember you saw it here first!) were made to put rare grid squares on the air, especially during contests. Why not partake of the fun and games in North America?

Thanks to Central States

Collecting grid squares is not actually a new concept to North America. The Central States VHF Society paved the way in

*Communications Manager, ARRL

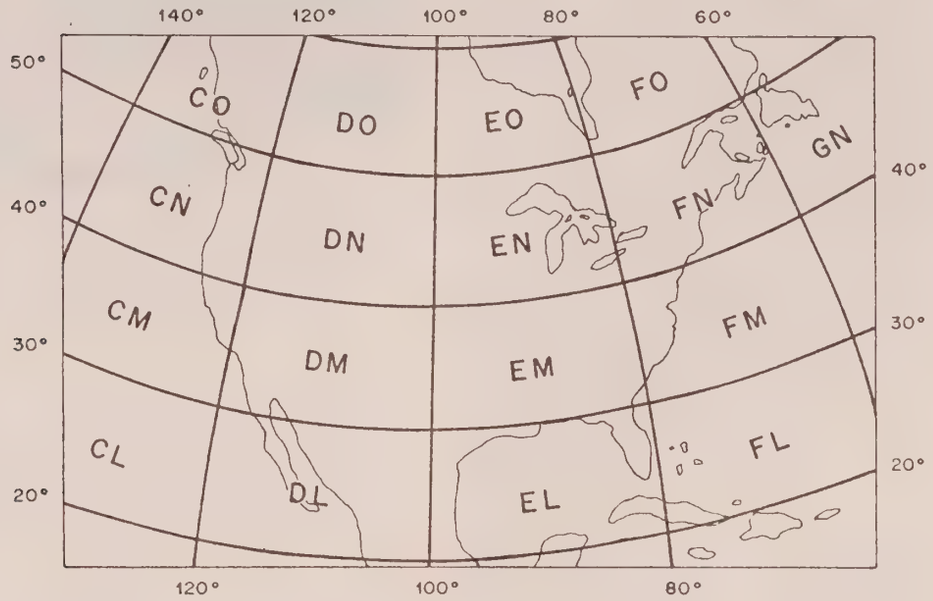
[1]Notes appear on page 51.

Table 1

How to Determine Your Grid Location†

†For those geographical areas not encompassed here, a complete explanation appears in the April 1982, issue of *The Lunar Letter*, entitled "Worldwide QTH Locator System Proposed by Region 1," by Lance Collister, WA1JXN.

1st and 2nd characters: Read directly from the map.



3rd character: Take the number of whole degrees west longitude, and consult the following chart.

Degrees West Longitude	*Third Character*	*Degrees West Longitude*	*Third Character*	*Degrees West Longitude*	*Third Character*
60-61	9	88- 89	5	114-115	2
62-63	8	90- 91	4	116-117	1
64-65	7	92- 93	3	118-119	0
66-67	6	94- 95	2	120-121	9
68-69	5	96- 97	1	122-123	8
70-71	4	98- 99	0	124-125	7
72-73	3	100-101	9	126-127	6
74-75	2	102-103	8	128-129	5
76-77	1	104-105	7	130-131	4
78-79	0	106-107	6	132-133	3
80-81	9	108-109	5	134-135	2
82-83	8	110-111	4	136-137	1
84-85	7	112-113	3	138-139	0
86-87	6				

4th character: This number is the same as the *2nd single digit* of your latitude. For example, if your latitude is 41° N, the 4th character is 1; for 29° N, it's 9, etc.

This four-character (2-letter, 2-number) designator indicates your 2° × 1° square for VUCC award purposes.

Table 2

More Precise Locator

To indicate location more precisely, the addition of 5th and 6th characters will define the *subsquare*, measuring about 4 × 3 miles. Longitude-latitude coordinates on maps, such as U.S. Department of the Interior Surveys, can be extrapolated to the nearest tenth of a minute, necessary for this level of locator precision. *This is not necessary in the VUCC awards program.*

5th character: If your number of degrees longitude is an *odd* number, see Fig. A. If your number of degrees longitude is an *even* number, see Fig. B.

Odd Longitude° (Fig. A)

Minutes W. Longitude	*5th Character*
0- 5	L
5-10	K
10-15	J
15-20	I
20-25	H
25-30	G
30-35	F
35-40	E
40-45	D
45-50	C
50-55	B
55-60	A

Even Longitude° (Fig. B)

Minutes W. Longitude	*5th Character*
0- 5	X
5-10	W
10-15	V
15-20	U
20-25	T
25-30	S
30-35	R
35-40	Q
40-45	P
45-50	O
50-55	N
55-60	M

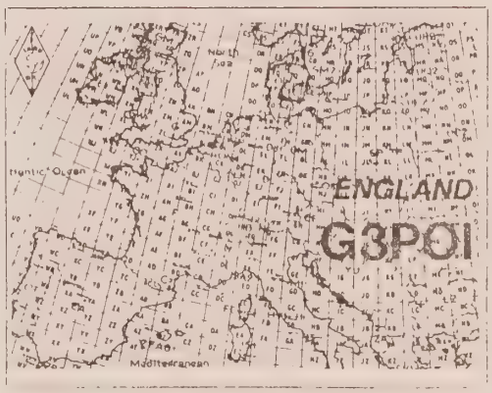
6th character: Take the number of *minutes of latitude* (following the number of degrees) and consult the following chart.

Minutes N. Latitude	*6th Character*
0- 2.5	A
2.5- 5.0	B
5.0- 7.5	C
7.5-10.0	D
10.0-12.5	E
12.5-15.0	F
15.0-17.5	G
17.5-20.0	H
20.0-22.5	I
22.5-25.0	J
25.0-27.5	K
27.5-30.0	L
30.0-32.5	M
32.5-35.0	N
35.0-37.5	O
37.5-40.0	P
40.0-42.5	Q
42.5-45.0	R
45.0-47.5	S
47.5-50.0	T
50.0-52.5	U
52.5-55.0	V
55.0-57.5	W
57.5-60.0	X

1981, when it announced a similar awards program. The intent was for ARRL to adopt the program eventually. This announcement is made with the full approval of the CSVHFS Board of Directors. Our thanks to Central States for providing valuable leadership.

Award Mechanics

Although the minute details for the award have not as yet been ironed out, this should not preclude anyone from starting on day 1. QSLs will be required, but verification will be conducted at the local level. ARRL-affiliated clubs that meet the requirements of the new Special Services Club program will be eligible to appoint a VHF Awards Manager, who



G3POI has collected 382 European QTH locator squares on 144 MHz. Clive has indicated his locator on the back of his grid-square QSL card. It is recommended that QSL cards indicate grid locators, just as they do states and counties.

Helpful operating hint: So that W1AW is always prepared to give out the correct grid locator during vhf QSOs, operator WA1POI has stenciled a sign at the operating position for quick reference. Good idea, Bruce!

will be duly certified to verify QSLs and applications for Hq. issuance of awards. Thus, it is expected that many certification points will be established throughout the U.S. and Canada. Overseas amateurs will be equally eligible for VUCC membership, with cards checked by those traditional awards managers who wish to assist. Detailed instructions will be provided to all involved in the verification procedure to insure uniformity of inspection.

No contacts are permitted for award purposes through repeater or active satellite devices. The first step in applying for the initial award is to request an application from ARRL. Included will be information as to the nearest verification point for sending QSLs. The VUCC certificate, endorsement stickers and grid maps of the U.S. will be available soon.

The VHF/UHF Ad Hoc Committee, which orchestrated this beehive of activity, has one more trick up its sleeve. I can't reveal all of its magic at this time, but I suggest you get your vhf running shoes ready and keep a keen eye in the coming months on the Contest Corral section of *QST*. You may have the opportunity to exchange grid squares on an organized basis sooner than you think!

For those of you who want to turn your computers loose on doing your grid-locator problems, you don't have to wait. WA5IED and SM5AGM have developed BASIC programs that should work well on most home computers.[2]

Good Luck

With this launching of the grid squares awards program, we wish you all luck. And we'll look forward to somebody operating from EL79, Apalachicola, Florida, a grid square that is 99% occupied by the Gulf of Mexico. QST

Notes

[1]km = mi × 1.6.
[2]*The Lunar Letter*, "Maidenhead Conversion Computer Programs," Oct. 1982, p. 24.

Strays

SANTA'S HELPER WAS A HAM

Few things are more satisfying to me than being able to give my husband *the* perfect Christmas gift . . . I mean, exactly what he wants, rather than a substitute for which I will be politely thanked while he tries to hide his disappointment. This year, I suffered no nagging doubts or indecision. Donald had done everything short of hiring a skywriter to let me know that he wanted a desk mike and a speaker to match his transceiver. He had purchased the rig, antenna tuner, and frequency counter from a close friend who, like most hams, took immaculate care of his ham gear. The addition of the microphone and speaker would make Don's station complete and attractive. It didn't seem much to ask. How little did I know!

Now that I knew what WA4RWD wanted for Christmas, my immediate problem was obtaining the money for the purchase. I had estimated the cost for both items to be about $80, which I didn't have, being unemployed. I could hardly ask Don for the money with which to buy his own gift. As I lay awake one night, chasing the problem in my thoughts, I decided to enlist the aid of a friend who has a lot of clout when it comes to solving problems. "Lord," I prayed silently, "I hope it isn't a sin to pray for money, but I need to earn $80 before Christmas so I can make my husband happy. Next morning, as I listened to the local radio station, I suddenly realized that my name was being broadcast. The disc jockey announced that I had won $100! Out of thousands of postcards entered in a contest, mine had been drawn. Feeling elated, I looked up and said, "Thank you, Lord."

As soon as the check arrived, I ordered the microphone. Now for the speaker. I got out my *QST* and phoned every dealer who had an advertisement. No one had the speaker. To my surprise, I was told that the company no longer manufactures that particular line of equipment. One dealer, after hearing my request, gave a wry little laugh and said, "Lady, you and 500 others are looking for that speaker." Another dealer didn't have the speaker, but he talked to me for 20 minutes anyway, because he was greatly amused by my Kentucky accent.

This was going to be tougher than I thought. I got my *QST* again and scanned every Ham Ad. Jackpot! A man in Alabama had the speaker for only $20. I phoned, only to be told that it had sold quickly. Okay; back to the ads. W1NW/8 in Ohio offered the speaker in a set with a receiver. Could I persuade him to sell the speaker separately? I phoned him, and a polite young man answered, informing me that Mr. Emely was not at home, but he would pass on the message. What if he returned my call and Don answered the phone? The surprise would be ruined. I was jolted from my worry by the ring of the phone. Mr. Emely was sorry, but his speaker was sold. He spoke kindly, offering helpful suggestions. As our conversation ended, he promised to try to help me locate another speaker. I hung up the phone, thinking that he was an exceptionally nice person, but not really believing that I would hear from him again.

Two days had passed when I received another call. I recognized the voice of W1NW/8. He had the speaker I wanted, and would be happy to ship it to me. I couldn't believe it! He had gone to the trouble of searching through the trade sheets, making inquiries, and checking with dealers until finally, he had found a dealer who had what I wanted. It was hard to believe that this man, to whom I was a total stranger, had put forth that much effort on my behalf, with nothing to gain for himself except my gratitude.

I could relax now, knowing that when Christmas morning came, my husband would turn to me with a smile and say, "See, hon, it's no trouble at all to buy a gift for me." Then I can laugh, and tell him everything. Until Christmas morning, I'll just smile mysteriously when I pass a box hidden under the bed. — *Shirley Harlow, N4FGD, Versailles, Kentucky*

I would like to get in touch with . . .

☐ anyone having or knowing the whereabouts of an HW-18 marine two-way radio or the amateur-band version, 160-meter, crystal-controlled receiver. Jack Ratzlaff, VE7DDS/VE5, 86 Culliton Crescent, Regina, SK S4S 4J6, Canada.

Arnold Littman, WA3BOH, mans the Amateur Radio station he designed and set up at the West Penn Hospital in Pittsburgh, Pennsylvania, the only hospital in the area with complete emergency communications capability.

This is a program, written in FORTRAN 77, by Ron McConnell, W2IOL, to convert geographical coordinates to grid squares. It was sent to the ARRL Hq and to Stan Horzepa, WA1LOU, who writes the "On Line" column for QST and who manages the Program Exchange (PX) for ARRL.

Ron's address is:

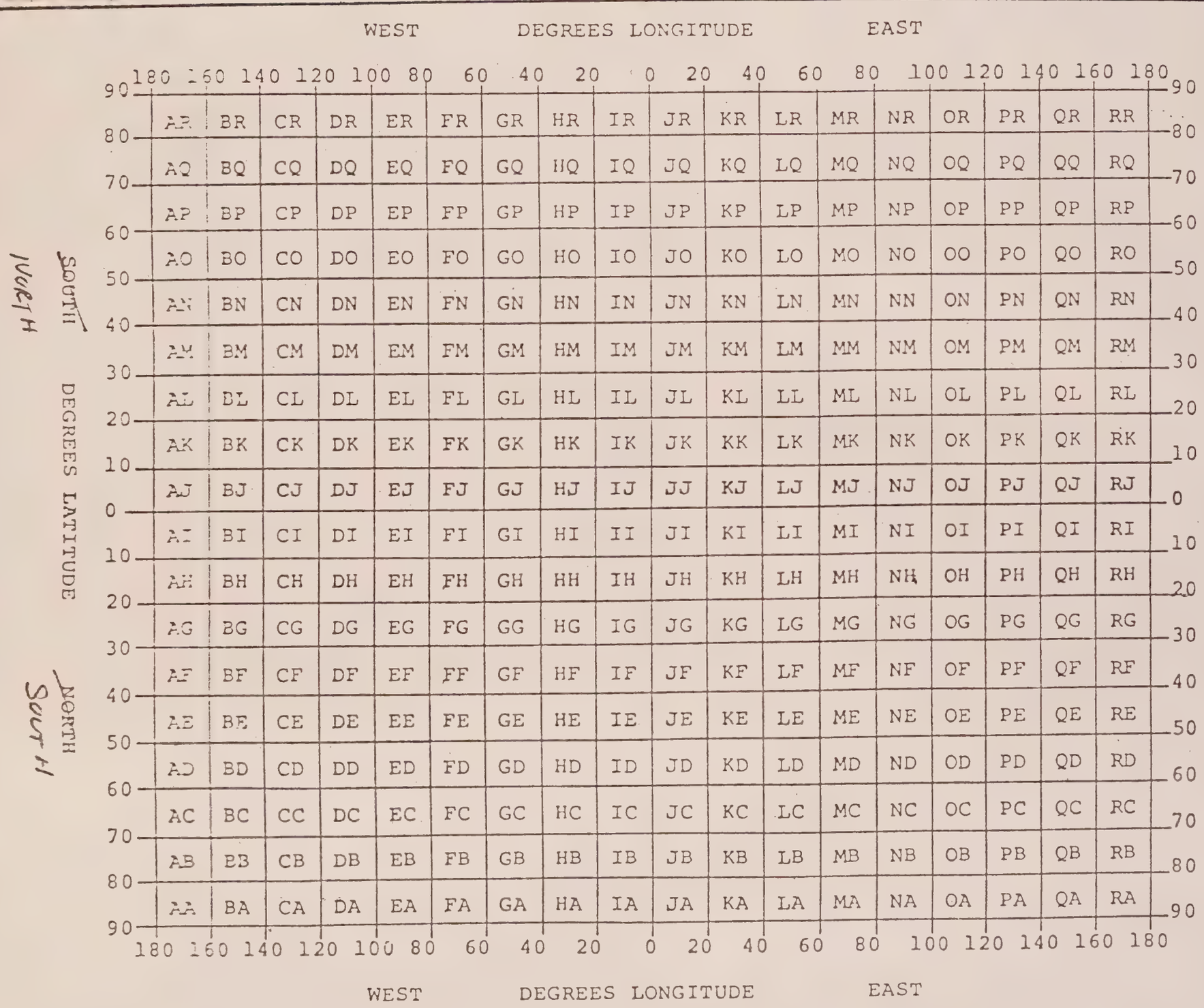
C/o Bell Laboratories, Room 2C228
Whippany Road
Whippany, NJ 07981

```
C      13 January 1983 and 18 October 1983
C
C                      Ronald C. McConnell, W2IOL
C
C       VUCC, VHF/UHF Century Club grid locator
C
C      "VUCC" determines the grid location in the "Maidenhead"
C         format as adopted by the IARU
C         given latitude and longitude of a QTH
C            in integer degrees ( no decimal ) and decimal minutes
C
C       The 1st and 2nd characters ( A to R ) define an area, "field,"
C          20 degrees in longitude by 10 degrees in latitude.
C
C       The 3rd and 4th characters ( 0 to 9 ) define an area, "square,"
C          2 degrees in longitude by 1 degree in latitude.
C
C       The 5th and 6th characters ( a to x ) define an area, 'sub-square,"
C          5 minutes in longitude by 2.5 minutes in latitude.
C            ( not needed for VUCC award )
C
C                    dd mm.m    ddd mm.m
C         Examples:  40 46.9 N, 074 41.4 W   =  FN20ps
C                    40 46.9 S, 074 41.4 E   =  ME79if
C
C       Note that latitude and longitude define a point.
C                 Grid location defines an area.
C
C         Characters 1, 3 and 5 start at 180 longitude and
C            increase alphabetically or numerically to the east.
C            Points on grid boundaries round to the east.
C
C         Characters 2, 4 and 6 start at 90 south latitude and
C            increase alphabetically or numerically to the north.
C            Points on grid boundaries round to the north.
C
C      See QST, January 1983, p49, "VHF/UHF Century Club Awards"
C           &   October 1983, p52, "Grid Locators for South America"
C         by John F. Lindholm, W1XX, ARRL Com. Mgr.
C
C       VUCC is written in a subset of fortran 77.
C
      integer lad, lod
      real lam, lom
      character n, s, e, w, grid(6)
      character ncap, scap, ecap, wcap
      character lans, loew, ok, yes, no, ycap
C
      data yes, no, ycap/ 'y', 'n', 'Y' /
      data n, s, e, w / 'n', 's', 'e', 'w' /
      data ncap, scap, ecap, wcap/ 'N', 'S', 'E', 'W' /
C
      print 1000
 1000 format( ' VUCC Grid Location from Latitude and Longitude' /
     &          10( ' ' ), 'W2IOL  10/18/83 version' / )
C
   30 print 1300
 1300 format( ' Latitude? dd mm.m N/S' )
      read( 5, 1310 ) lad, lam, lans
 1310 format( i2, 1x, f4.1, 1x, a1 )
      if( ( lans .eq. s ) .or. ( lans .eq. scap ) )
     &   then
            lans = scap
         else
            lans = ncap
      end if
```

```
      print 1320, lad, lam, lans
 1320 format( i2, 1x, f4.1, 1x, a1, '    ok? y/n:' )
      read( 5, 1340 ) ok
 1340 format( a1 )
      if( ( ok .eq. no ) .or. ( ok .eq. ncap ) ) go to 30
C
   40 print 1400
 1400 format( ' Longitude? ddd mm.m W/E' )
      read( 5, 1420 ) lod, lom, loew
 1420 format( i3, 1x, f4.1, 1x, a1 )
      if( ( loew .eq. e ) .or. ( loew .eq. ecap ) )
     &   then
            loew = ecap
         else
            loew = wcap
      end if
      print 1450, lod, lom, loew
 1450 format( i3, 1x, f4.1, 1x, a1, '    ok? y/n:' )
      read( 5, 1340 ) ok
      if( ( ok .eq. no ) .or. ( ok .eq. ncap ) ) go to 40
C
      call mhgrid( lad, lam, lans, lod, lom, loew, grid )
      print 1900, grid
 1900 format( ' VUCC grid location = ', 6a1 )
C
      print 2000
 2000 format( / 30( '-' ) / ' more? y/n:' )
      read( 5, 1340 ) ok
      if( ( ok .eq. no ) .or. ( ok .eq. ncap ) )
     &   then
            stop
         else
            go to 30
      end if
C
      end
C
C
C
      subroutine mhgrid( lad, lam, lans, lod, lom, loew, grid )
C       07 January 1983,   18 October 1983
C        Ronald C. McConnell, W2IOL
C
      integer lad, lod, latdeg, lngdeg
      real lam, lom, latmin, lngmin
      character lans, north, south, loew, east, west
      character grid(6), ltrbig(26), ltrsml(26), nbrchr(10)
C
      data north, south, east, west / 'N', 'S', 'E', 'W' /
      data nbrchr / '1', '2', '3', '4', '5', '6', '7', '8', '9', '0' /
      data ltrsml/ 'a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i',
     &             'j', 'k', 'l', 'm', 'n', 'o', 'p', 'q', 'r',
     &             's', 't', 'u', 'v', 'w', 'x', 'y', 'z' /
      data ltrbig/ 'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I',
     &             'J', 'K', 'L', 'M', 'N', 'O', 'P', 'Q', 'R',
     &             'S', 'T', 'U', 'V', 'W', 'X', 'Y', 'Z' /
C
C         Translate latitude relative to 90 south, South Pole
C
      if( lans .eq. north )
     &   then
C              "north"
            latdeg = 90 + lad
            latmin = lam
         else
C              south
```

```
            if( lam .eq. 0.0 )
     &         then
                  latdeg = 90 - lad
                  latmin = 0.0
               else
                  latdeg = 89 - lad
                  latmin = 60.0 - lam
               end if
         end if
C
C        Translate longitude relative to 180 meridian
C              increasing toward the east
C
         if( loew .eq. west )
     &   then
C              "west"
            if( lom .eq. 0.0 )
     &         then
                  lngdeg = 180 - lod
                  lngmin = 0.0
               else
                  lngdeg = 179 - lod
                  lngmin = 60.0 - lom
            end if
         else
C              "east"
            lngdeg = 180 + lod
            lngmin = lom
         end if
C
C        NOTE: integer arithmetic with lngdeg and latdeg
C              meaning all fractional parts truncated
C
C        First Character = capital letter, A to R,
C              based on 20 degree longitude block from 180 meridian
C
         k = ( lngdeg / 20 ) + 1
C           Meridian 180
         if( k .eq. 19 ) k = 18
C
         grid( 1 ) = ltrbig( k )
C
C        Second Character = capital letter, A to R,
C              based on 10 degree latitude block from South Pole
C
         k = ( latdeg / 10 ) + 1
C        North Pole
         if( k .eq. 19 ) k = 18
C
         grid( 2 ) = ltrbig( k )
C
C        Third Character = number, 0 to 9, based on
C              position within 20 degree longitude block
C
         lotwty = lngdeg / 20
         k = ( lngdeg - ( lotwty * 20 ) ) / 2
         if( k .eq. 0 ) k = 10
         grid( 3 ) = nbrchr( k )
C
C        Fourth Character = number, 0 to 9, based on
C              position within 10 degree latitude block
C
         latens = latdeg / 10
         k = latdeg - ( latens * 10 )
         if( k .eq. 0 ) k = 10
         grid( 4 ) = nbrchr( k )
```

```
C
C          Fifth Character = small letter, a to x,
C            in 5 minute longitude blocks
C            based on odd or even longitude degrees
C
C              Note: real variables latmin and lngmin "ifix"ed
C                    to integers
C
      if( loew .eq. east )
     &   then
            j = ifix( lngmin / 4.999 ) + 1
         else
            j = ifix( lngmin / 5.001 ) + 1
      end if
      neveod = ( lngdeg / 2 ) * 2
      if( lngdeg .eq. neveod )
     &   then
C                 "even"
             k = j
         else
C                 "odd"
             k = 12 + j
             if( k .eq. 25 ) k = 1
      end if
      grid( 5 ) = ltrsml( k )
C
C          Sixth Character = small letter, a to x,
C                in 2.5 minute latitude blocks
C
      if( lans .eq. north )
     &   then
            k = ifix( latmin / 2.499 ) + 1
         else
            k = ifix( latmin / 2.501 ) + 1
      end if
      if( k .eq. 25 ) k = 1
      grid( 6 ) = ltrsml( k )
C
C     South Pole grid( 2 ) = "A", North Pole grid( 2 ) = "R"
C
      if( lad .eq. 90 ) then
         grid( 1 ) = ltrbig( 1 )
         grid( 3 ) = nbrchr( 10 )
         grid( 4 ) = nbrchr( 10 )
         grid( 5 ) = ltrsml( 1 )
         grid( 6 ) = ltrsml( 1 )
      end if
C
C        Meridian 180
C
      if( lod .eq. 180 ) then
         grid( 1 ) = ltrbig( 1 )
         grid( 3 ) = nbrchr( 10 )
         grid( 5 ) = ltrsml( 1 )
      end if
C
      return
      end
```



REGION 1 LOCATOR SYSTEM CONVERSION TABLE FOR FIELDS (CHARACTERS 1 AND 2)

MINUTES EAST LONGITUDE

MINUTES NORTH LATITUDE	0	10	20	30	40	50	60	70	80	90	100	110	120	MINUTES SOUTH LATITUDE
60	AX	BX	CX	DX	EX	FX	GX	HX	IX	JX	KX	LX	MX	NX	OX	PX	QX	RX	SX	TX	UX	VX	WX	XX	0
55	AW	BW	CW	DW	EW	FW	GW	HW	IW	JW	KW	LW	MW	NW	OW	PW	QW	RW	SW	TW	UW	VW	WW	XW	5
	AV	BV	CV	DV	EV	FV	GV	HV	IV	JV	KV	LV	MV	NV	OV	PV	QV	RV	SV	TV	UV	VV	WV	XV	
50	AU	BU	CU	DU	EU	FU	GU	HU	IU	JU	KU	LU	MU	NU	OU	PU	QU	RU	SU	TU	UU	VU	WU	XU	10
	AT	BT	CT	DT	ET	FT	GT	HT	IT	JT	KT	LT	MT	NT	OT	PT	QT	RT	ST	TT	UT	VT	WT	XT	
45	AS	BS	CS	DS	ES	FS	GS	HS	IS	JS	KS	LS	MS	NS	OS	PS	QS	RS	SS	TS	US	VS	WS	XS	15
	AR	BR	CR	DR	ER	FR	GR	HR	IR	JR	KR	LR	MR	NR	OR	PR	QR	RR	SR	TR	UR	VR	WR	XR	
40	AQ	BQ	CQ	DQ	EQ	FQ	GQ	HQ	IQ	JQ	KQ	LQ	MQ	NQ	OQ	PQ	QQ	RQ	SQ	TQ	UQ	VQ	WQ	XQ	20
	AP	BP	CP	DP	EP	FP	GP	HP	IP	JP	KP	LP	MP	NP	OP	PP	QP	RP	SP	TP	UP	VP	WP	XP	
35	AO	BO	CO	DO	EO	FO	GO	HO	IO	JO	KO	LO	MO	NO	OO	PO	QO	RO	SO	TO	UO	VO	WO	XO	25
	AN	BN	CN	DN	EN	FN	GN	HN	IN	JN	KN	LN	MN	NN	ON	PN	QN	RN	SN	TN	UN	VN	WN	XN	
30	AM	BM	CM	DM	EM	FM	GM	HM	IM	JM	KM	LM	MM	NM	OM	PM	QM	RM	SM	TM	UM	VM	WM	XM	30
	AL	BL	CL	DL	EL	FL	GL	HL	IL	JL	KL	LL	ML	NL	OL	PL	QL	RL	SL	TL	UL	VL	WL	XL	
25	AK	BK	CK	DK	EK	FK	GK	HK	IK	JK	KK	LK	MK	NK	OK	PK	QK	RK	SK	TK	UK	VK	WK	XK	35
	AJ	BJ	CJ	DJ	EJ	FJ	GJ	HJ	IJ	JJ	KJ	LJ	MJ	NJ	OJ	PJ	QJ	RJ	SJ	TJ	UJ	VJ	WJ	XJ	
20	AI	BI	CI	DI	EI	FI	GI	HI	II	JI	KI	LI	MI	NI	OI	PI	QI	RI	SI	TI	UI	VI	WI	XI	40
	AH	BH	CH	DH	EH	FH	GH	HH	IH	JH	KH	LH	MH	NH	OH	PH	QH	RH	SH	TH	UH	VH	WH	XH	
15	AG	BG	CG	DG	EG	FG	GG	HG	IG	JG	KG	LG	MG	NG	OG	PG	QG	RG	SG	TG	UG	VG	WG	XG	45
	AF	BF	CF	DF	EF	FF	GF	HF	IF	JF	KF	LF	MF	NF	OF	PF	QF	RF	SF	TF	UF	VF	WF	XF	
10	AE	BE	CE	DE	EE	FE	GE	HE	IE	JE	KE	LE	ME	NE	OE	PE	QE	RE	SE	TE	UE	VE	WE	XE	50
	AD	BD	CD	DD	ED	FD	GD	HD	ID	JD	KD	LD	MD	ND	OD	PD	QD	RD	SD	TD	UD	VD	WD	XD	
5	AC	BC	CC	DC	EC	FC	GC	HC	IC	JC	KC	LC	MC	NC	OC	PC	QC	RC	SC	TC	UC	VC	WC	XC	55
	AB	BB	CB	DB	EB	FB	GB	HB	IB	JB	KB	LB	MB	NB	OB	PB	QB	RB	SB	TB	UB	VB	WB	XB	
0	AA	BA	CA	DA	EA	FA	GA	HA	IA	JA	KA	LA	MA	NA	OA	PA	QA	RA	SA	TA	UA	VA	WA	XA	60
	120	110	100	90	80	70	60	50	40	30	20	10	0												

MINUTES WEST LONGITUDE

REGION 1 LOCATOR SYSTEM CONVERSION TABLE FOR SUBSQUARES (CHARACTERS 5 AND 6)
(ONE COMPLETE SQUARE IS SHOWN)

NOTE: SUBSQUARES STARTING WITH LETTERS A THROUGH L ARE IN THE WEST 1° X 1° HALF OF THE SQUARE, WHILE THOSE STARTING WITH M THROUGH X ARE IN THE EAST 1° X 1° HALF

#8 March 1984

NEPRA PacketEar

Newsletter of the New England Packet Radio Association

HELP WANTED

Needed: a few good men (or women) to help develop the state of the art and to go where no ham has gone before. That may be a bit overly-dramatic, yet it is essentially true. There is a great new frontier to explore in Amateur Radio and our organization has a depth of talent that packet radio clubs in other parts of the country would envy.

Here along the High Technology Highways of New England, many hams are exposed to state of the art technologies at work. They have a unique opportunity to apply some of these technologies to Amateur Radio. This is also a two-way street: technological skills developed in Ham Radio may have a payback at your place of employment.

With that in mind, I would like to review some of the thrusts that NEPRA and/or NEPRA members are presently persueing. Each one of these projects is presently short-handed and needs your assistance.

NETWORK and INTER-NETWORK DESIGN: This project will grow into a backbone network for the East Coast. It has received encouragement from the ARRL and only needs hardware, software, radios and antennas on mountaintops to work! A ground-floor opportunity! This is presently being persued by KQ1E, K1KSY, KD2S, WA1GRC, WB2OSZ and others. Even more are needed.

HIGH-SPEED RF MODEMS: Again, a ground-floor opportunity is here to push the present technology. The present goal of 9600 baud is probably only a stepping stone along the way. Gary Field has been laboring on this one with very little assistance, I suspect he would welcome a helping hand.

HF PACKET ACTIVITIES: Much talk here, very little action. This is a pet project of the League, you might find assistance in Newington.

BULLETIN BOARD SYSTEMS: Two part-time systems are in operation. Equipment is available NOW for a full-time dedicated BBS, including a hard disk with oodles of storage. The only item missing is someone to get it operational.

PACKET-to-AMTOR LINKS: A good effort is being done by KQ1E. Anyone else?

PROTOCOL DEVELOPMENT: In addition to the InterNetworking

developments being done, who says that the present AX.25 is perfect? Is it suited for HF? Meteor Scatter? Roundtables? Nets?

PORTABLE PACKET POCKET PAGER: Yes, this mouthful is under serious consideration by League officials for use by National Traffic System members. Again, support is available from Newington.

Less-technical projects also need manning (here's where those of us without engineering degrees can still help):

PRESENTATIONS: Some of us are beginning to feel like fundamentalist preachers on horseback going forth to preach to the masses. We need help spreading the word. This does 2 things: 1) gets more members, and 2) helps justify our existence on the bands by publicizing our ideas.

NEWSLETTERS: If you enjoy reading this publication monthly, please be aware that John Langner, WB2OSZ, has been putting out this fine newsletter with almost no help! John now has a few other responsibilities (like a brand new baby).

TRAFFIC HANDLING: The National Traffic System has already expressed some interest in applying the technology we are developing. Can you picture a traffic handling net that is in operation 24 hours a day and has a computer as NCS? All this on a shared frequency, too.

OFFICIAL BULLETIN STATIONS: We have at our fingertips the technology to disperse information quickly and accurately. So far, we have not utilized this to any degree.

PUBLIC SERVICE WORK: Start asking about some of the upcoming needs: thousands of Shriners descending upon Boston this summer, canoe races, foot races, etc. Again, a need for high speed and high accuracy message handling.

Am I rambling on too much? Well, perhaps so. However, I have a point to make. We are standing at the introduction of a new technology in Ham Radio that will certainly create changes, if not revolutions. We in NEPRA have an opportunity to expand upon work already done in other parts of the continent, and to actually apply this technology to needed applications. In the past few months, this work has been done by a very few individuals. If the rest of us stand back and let the others do all the work, we will all be the losers. If all of us pitch in and contribute a bit, we all benefit. In the next few months, I may be asking for (drafting?) volunteers to help on specific projects. Please think carefully about what you can contribute to the hobby we all seem to enjoy so much.

73,

Dick Eastman, K1OJH

President, NEPRA

Notes from the February 19, 1984 ARRL/NEPRA Meeting

(de KD2S)

ATTENDEES:
NEPRA: / Dick K1OJH / John WB7VJK / John WB2OSZ / Den KD2S /
/ Gary WA1GRC / Andy KA1M / Eric WB1HBU / John K1KSY /
ARRL: / Paul W4RI / Jeff K8KA /

The meeting began with a tour of ARRL headquarters by W4RI. Paul then began "formal" meetings with an explanation of current ARRL packet activity - they are on the air with the League's VADCG TNC on 145.01 MHz, having gotten the system going for the first time minutes before we arrived!

The ARRL's interests were then identified - They have a need to stir up more interest in the local (Hartford) area. The League's digipeater is expected to help considerably (as might some interesting things to hook up to in E.Mass!). Paul's HF packet-adaptive modem (PAM) is currently in the PC board stuffing stage, and he is looking for interested groups who want to test this mode. The League is also very actively looking for construction projects for QST, and experimenter's articles for QEX. In addition to Jeff, who is very interested in packet hardware, Paul has hired Jon Bloom from AMRAD group, who will bring his excellent software talents to the League. (John wrote the original AX.25 VADCG repeater software.)

K1OJH led off the first salvo for NEPRA, explaining briefly all of the activities we're currently involved in. Dick then described the WORLI and K1OJH BBS's, and was followed by WB7VJK who described the new version 1 Pascal BBS system that he is writing. Dick also mentioned the desires of NEPRA to become involved in packet feeds of ARRL bulletins, and in NTS traffic handling over the medium. WB2OSZ explained some of the details of the automatic station operation he has been experimenting with. WA1GRC discussed the current status of the 220MHz 9600b/s modem project. KD2S began the presentation of the joint linking experiments with an overview, and the group broke for lunch.

KD2S explained the Mt. Greylock proposal in some detail after lunch. K1KSY and KA1M described the satellite links which should be available in our area, and KD2S described KQ1E's current AMTOR and planned METSCAT activity. W4RI will incorporate our efforts with those of other ARRL groups in a joint special temporary authority (STA) to allow linking between amateur and amateur satellite digital systems.

W4RI then explained his ideas on the future of packet. He is primarily interested in: 1) HF packet using adaptive modems, 2) 6 meter 9600 b/s METSCAT experiments, 3) 56 k/s 220 MHz backbone linking systems, and 4) the growth of packet into a world-wide network by the end of the decade. The latter desire includes all of the current 2 meter work, of course.

W4RI then explained a few of the packet activities in other areas

which might be of interest to us:

1) HF PAM - modem which will adjust data rate to match available propagation conditions. The control protocol was briefly described, including initial requirements and further enhancements. This modem will be described in more detail at this week's meeting. W4RI is ESPECIALLY interested in a joint ARRL/NEPRA software development effort for the S-100 - based PC card subsystem.

2) "Horsey Packet" - an AX.25 modification developed especially for packet activities used in covering (horse) races and the like (canoe races, marathons?). Equivalent to a broadcast mode with acknowledgement by all stations, and good for keeping updated information at all stations involved in an event.

3) "Packet Pager" - a device to allow one-way transmission of alert and status information to members of the NTS/TCC corps. Pocket-sized VHF or HF receiver with small LCD display, allowing addressed alert information from AX.25 packet stations to traffic handlers/managers.

The meeting ended with a large number of action items to be handled by both groups immediately, and in the next few months. Some of the more important are:

- o shipping of BBS source code to Newinston (KD2S 2/21)
- o ARRL operational on packet to NEPRA on 145.01 (WORLI/K8KA 2/28)
- o test distribution of bulletins on packet (K1OJH/W4RI)
- o presentation to NOBARC by NEPRA/SARA (KD2S 3/25)
- o ARRL/NEPRA sponsored METSCAT conference (9/15)
- o network-level linking discussions at ARRL level three protocol specifications conference (8/4)
- o STA for satellite linking (3/9)

NEPRA MEETINGS: A meeting is held at the Honeywell plant in Billerica at 7:30 PM on the fourth Thursday of each month. Take Route 3 to exit 27, Concord Road. Go west a couple hundred yards and you will see a sign and entrance for Honeywell on the left. Go way around to the back of the building. Talk in is available on 147.12 MHz.

NEXT MEETING: 22nd of March.

WEEKLY NET: A weekly net is held on the Billerica repeater (147.12 MHz, +600 input) at 8:00 PM most Thursday nights.

OFFICIAL ADDRESS: for $15 annual dues, etc.:

New England Packet Radio Association
P. O. Box
Bedford, MA 01730

NEWSLETTER INPUTS: Best way is a message to WB2OSZ in either WORLI or K1OJH mailbox system.

NEPRA Meeting Minutes
February 23, 1984

Minutes of the January meeting were read because many people hadn't received the newsletter yet.

PUBLIC SERVICE / CANOE RACE: We need volunteers to help out with communications. See article last month for details.

DEMODULATOR MODIFICATION: WORLI and WA1GRC tried the TAPR demodulator improvement passed out last time (and published last month) and reported favorable results. Hank, WORLI, passed out free precision resistors and capacitors required for the modification.

AMTOR GATEWAY: The KQ1E Packet/AMTOR gateway is now operational. Legal aspects of having the signals of a Technician class operator automatically retransmitted on 20 meters were discussed.

"VANCOUVER VIRUS" is gone now that AX.25 software has arrived for GLB units. There are some GLB / TAPR compatiblity problems with the default parameter settings. Specifying "TRACE $80" at the TAPR end and restricting packet size at GLB end seem to solve the problem.

ARRL TRIP: 8 NEPRA members visted the ARRL recently to discuss packet radio and related topics. [See Den's report earlier in this issue. Contact Paul Rinaldo if you'd like to get involved in the Pocket Packet Pager or PAM projects.]

HARDWARE FLOW CONTROL: Dave, KA1MI, has been having trouble getting hardware flow control working for data coming from the TNC. When the TNC is told to stop sending to the computer, characters tend to get lost or garbled. Other people had the same problem. [Maybe someone who has figured out how to do it can write a short article for us. I've been using software (XON/XOFF) flow control and it works fine. -editor]

DEERFIELD FLEA MARKET: Rolf, KE1Y, is organizing packet radio demonstrations (mobile and other) for the Deerfield ham radio flea market. Contact him if you'd like to help out the day before Mothers' Day. KA1MI and/or KA1M will look into getting booths and presentation slots for Boxboro and NYC.

PRESENTATIONS: Scheduled for Norwood, Sharon, and Leominster over the next few weeks.

John Langner, WB2OSZ
secretary

VICTERM Update (de WA1GRC)

I have a correction for my VICTERM program. This was pointed out by W1TTY. Line 1560 should read as follows:

```
1560 IF (PEEK(37151) AND 64) = 1 THEN 1560
```

Deviation Adjustment for Packet Operation

Gary Field WA1GRC

Newcomers to packet radio may not realize the importance of proper deviation adjustment, however under deviation will result in poor noise tolerance, and over deviation will result in high error rate and inter-channel splatter. Proper deviation is approximately +/- 4 kHz peak deviation, this keeps the sidebands toward the middle of the passband away from the phase-distorting rolloff frequencies. Since every packet station is using different combinations of equipment no "fixed" set of potentiometer settings will produce proper deviation. This adjustment must be performed when a station is first set up for packet, it normally will not change much with time providing none of the equipment is replaced or serviced. The best method of adjusting the deviation is to use a deviation meter, however, since most hams do not have access to one of these, an alternate, less precise but adequate method will be outlined here.

The only test equipment required is an extra FM receiver operating on the same frequency as the packet transmitter and your ears, This receiver should have IF filters no wider than 15 kHz. Filters wider than this will result in overdeviation when you use the following technique.

1. Connect the tone output from the TNC to the radio, connect a 50 ohm dummy load to the transmitter output, and turn the radio on.

2. Turn the tone output from the TNC all the way down.

3. Turn on the extra receiver and set to same frequency as the packet rig, it is generally best not to connect an antenna to this receiver.

4. Slowly increase the audio output level from the TNC. The tone in the extra receiver should get louder and louder until no further increase in output is noticed, STOP when this point is reached.

5. Decrease the output from the TNC until a DEFINITE decrease in volume is noted (about 3 to 4 dB). Set the output of the TNC slightly below this level.

Let me explain why this method works. When the audio level into an FM radio is increased, a corresponding increase in RF bandwidth is caused. What we have done is use a receiver with a known IF bandwidth to tell us when the RF bandwidth is equal to the IF bandwidth. This happens because when we start deviating past the edges of the IF filter, no further increase in volume will result, the signal will only get more distorted. If your signal sounds louder or softer than most of the others on the channel you should suspect that your deviation is not optimum even if your packet station seems to work fairly well. Do not use distant noisy signals for this comparison, but most others should sound about the same. After a while you will be able to recognize packets signals which are not properly adjusted for deviation and also tone calibration. Tone calibration is not a problem with the TAPR TNC since a very nice software calibration function is included in the onboard PROM, however other TNCs must be calibrated using a frequency counter. The two tones must typically be set to within 20 Hz if good performance is to be expected.

From Lunar Letter, April 1982

Worldwide QTH Locator System Proposed By Region 1

by WA1JXN
Lance Collister

For about thirty years European VHF and UHF amateurs have been using a location abbreviation system called the QRA Locator. The system was introduced in West Germany to provide a short and convenient way of exchanging QTH information during contests, which were scored on the basis of distance. The popularity of the system grew far greater than originally anticipated and it was not long before the system saw use outside of contests and in other parts of Europe, northern Africa and western Asia. Unfortunately, the system was not designed to cover a larger area than Europe, making the extension of the system to worldwide use impractical. Also, there were a number a awkward and illogical features of the system which became apparent after extensive use.

For these reasons there has been an increasing need for a better system in Region 1 and since any new system should clearly cover the entire world (especially now with the widespread growth in EME and satellites), the European VHF Managers met during 1980 in England (near London) to review the many proposed replacement locator systems and endorse one of them for worldwide adoption. The one which was chosen was a system proposed by G4ANB that has since become known as the "Maidenhead Locator System" and is the system currently being proposed by Region 1.

Obviously, there is some reluctance on the part of European VHFers to "switch in midstream" to a different locator, particularly when they have spent so much time chasing awards which are based on the old locator system. However, the proposed system is also based on 2° X 1° geographic divisions like the old system and the inconvenience of changing is outweighed by the advantages the new system has to offer. Nevertheless, one of the big reasons to change would be to take advantage of the worldwide feature, which is not really an incentive to switch unless the rest of the world decides to use the new Region 1 Locator. The result is that there will be much more acceptance of the system by European amateurs if we adopt it over here, and there seems to have been some reluctance to actively use the system over here without some assurance that the system would be widely adopted in Europe. The point is that we should at least familiarize ourselves with this system and probably start using it in order to get the ball rolling. It (a locator system) did far more to encourage VHF/UHF activity in Europe than was ever anticipated and it could also prove to be very popular here, too.

One arguement against use of the Region 1 locator has been that it is based on 2° X 1° geographic divisions, which are different than the 1° X 1° Grids used in the ARRL UHF contests and the CSVHF Society WHG Award. The truth, however, is that the QTH Locator code does easily identify which 1° X 1° half of a 2° X 1° "Square" a station is located in. It is also not hard to use! Just see ...

In the QTH Locator system proposed by Region 1, the Earth's surface is divided into 18 X 18 "FIELDS", each of which is 20° wide and 10° high. Each FIELD is in turn divided into 100 "SQUARES", each 2° wide and 1° high. Each SQUARE is divided into "SUBSQUARES", each 5' wide and 2.5' high. The QTH Locator code is 6 characters long (two characters, one for longitude and one for latitude, at each division level). The first two characters (always letters) indicate the longitude and latitude, respectively, of the FIELD. The third and fourth characters (always numbers) denote the longitude and latitude, respectively, of the SQUARE. The last two characters (always letters) indicate the longitude and latitude of the SUBSQUARE.

To determine the QTH Locator code for any given location, the first step is to convert the longitude and latitude to degrees and minutes. Then use the coversion key shown; if the location is East Longitude or South Latitude, read the locator code characters off the top of the coversion scales and if it is West Longitude or North Latitude, use the characters found by reading along the bottom of the conversion scales. Remember to always read to the next higher character.

For example, convert 114° 15' 20" West and 47° 2' 54" North to the proper QTH Locator code:

1. First round off location to 114° 15.33' West and 47° 2.9' North.
2. Longitude 114° West gives a first character of D, and a third character of 2.
3. The rest of the longitude, 15.33', gives a fifth character of U.
4. Latitude 47° North gives a second character of N and a fourth character of 7.
5. The rest of the latitude, 2.9', gives a sixth character of B.
6. The result is: DN 27 UB.

See - there's nothing to it! You will also notice that the above QTH happens to be in the eastern 1° X 1° Grid of the 2° X 1° Square DN 27 (just in case you are in the habit of collecting 1° X 1° Grids), since the fifth character is between M and X, inclusive.

It would be a shame not to adopt a locator system which the Europeans have already developed for us - specifically to avoid the pitfalls of their old system and incorporate the features which their years of experience have shown to be important. Perhaps if we start using this system, it will gain some acceptance for ARRL contests, as well as provide a common basis for awards and contests worldwide.

Good luck and DX! de WA1JXN

KEY TO DETERMINING A QTH LOCATOR CODE UNDER SYSTEM PROPOSED BY REGION 1

LONGITUDE: FIRST CHARACTER

DEGREES ~~EAST~~ WEST LONGITUDE 0 20 40 60 80 100 140 180

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R

180 140 100 80 60 40 20 0 DEGREES ~~WEST~~ EAST LONGITUDE

THIRD CHARACTER

0 2 4 6 8 10 12 14 16 18 20 DEGREES EAST LONGITUDE

0	1	2	3	4	5	6	7	8	9

20 18 16 14 12 10 8 6 4 2 0 DEGREES WEST LONGITUDE

MINUTES EAST 0 10 20 30 40 50 60 70 80 90 100 110 120

FIFTH CHARACTER

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X

MINUTES WEST 120 110 100 90 80 70 60 50 40 30 20 10 0

ODD LONG. EVEN LONG.

LATITUDE: SECOND CHARACTER

90 80 70 60 50 40 30 20 10 0 DEGREES ~~SOUTH~~ LATITUDE

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R

DEGREES ~~NORTH~~ SOUTH LATITUDE 0 10 20 30 40 50 60 70 80 90

FOURTH CHARACTER

10 9 8 7 6 5 4 3 2 1 0 DEGREES SOUTH LATITUDE

0	1	2	3	4	5	6	7	8	9

0 1 2 3 4 5 6 7 8 9 10 DEGREES NORTH LATITUDE

MINUTES SOUTH 60 55 50 45 40 35 30 25 20 15 10 5 0

SIXTH CHARACTER

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X

MINUTES NORTH 0 5 10 15 20 25 30 35 40 45 50 55 60

DEGREES EAST LONGITUDE

0 2 4 6 8 10 12 14 16 18 20

10	09	19	29	39	49	59	69	79	89	99	0
9	08	18	28	38	48	58	68	78	88	98	1
8	07	17	27	37	47	57	67	77	87	97	2
7	06	16	26	36	46	56	66	76	86	96	3
6	05	15	25	35	45	55	65	75	85	95	4
5	04	14	24	34	44	54	64	74	84	94	5
4	03	13	23	33	43	53	63	73	83	93	6
3	02	12	22	32	42	52	62	72	82	92	7
2	01	11	21	31	41	51	61	71	81	91	8
1	00	10	20	30	40	50	60	70	80	90	9
0											10

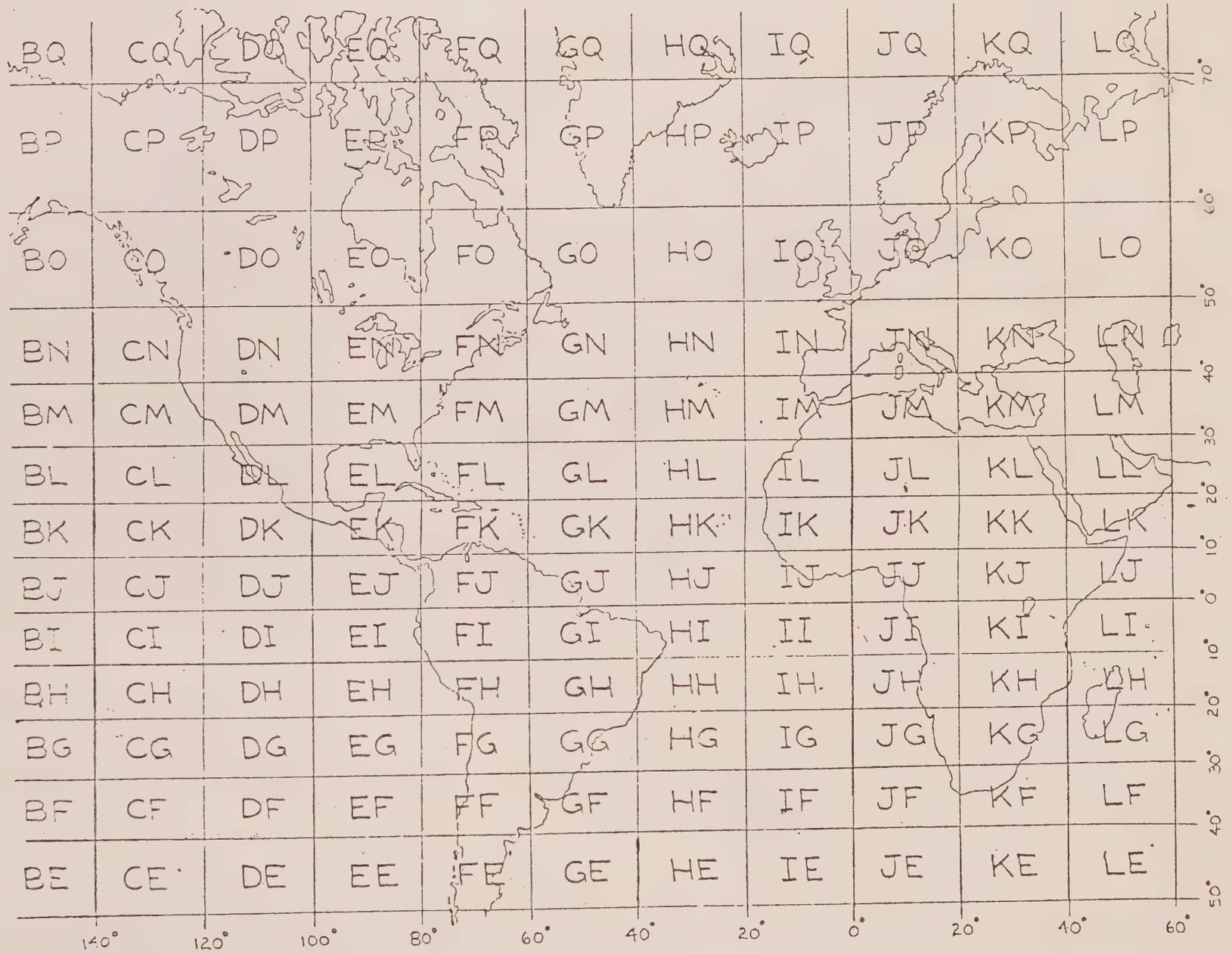
20 18 16 14 12 10 8 6 4 2 0

DEGREES NORTH LATITUDE

DEGREES SOUTH LATITUDE

DEGREES WEST LONGITUDE

REGION 1 LOCATOR SYSTEM CONVERSION TABLE FOR SQUARES (CHARACTERS 3 AND 4)
(ONE COMPLETE FIELD IS SHOWN)


BQ CQ DQ EQ FQ GQ HQ IQ JQ KQ LQ
BP CP DP EP FP GP HP IP JP KP LP
BO CO DO EO FO GO HO IO JO KO LO
BN CN DN EN FN GN HN IN JN KN LN
BM CM DM EM FM GM HM IM JM KM LM
BL CL DL EL FL GL HL IL JL KL LL
BK CK DK EK FK GK HK IK JK KK LK
BJ CJ DJ EJ FJ GJ HJ IJ JJ KJ LJ
BI CI DI EI FI GI HI II JI KI LI
BH CH DH EH FH GH HH IH JH KH LH
BG CG DG EG FG GG HG IG JG KG LG
BF CF DF EF FF GF HF IF JF KF LF
BE CE DE EE FE GE HE IE JE KE LE
140° 120° 100° 80° 60° 40° 20° 0° 20° 40° 60°
70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30° 40° 50°

PRIMARY CATEGORIES

AM - AMSAT (OFFICE, PAID STAFF, ETC)
AR - ARRL CONTACT
BN - BULLETIN STATION
CA - ORBITAL CALCULATORS AND SOFTWARE
CM - COMMAND STATION
DR - DIRECTOR
DV - DEVELOPMENT
ED - EDUCATION
EG - ENGINEERING
FA - FINANCIAL ADVISOR
LA - LEGAL ADVISOR
MS - MEMBERSHIP SERVICES
NC - NATIONAL COORDINATOR
NS - NATIONAL AMSAT SOCIETY
NT - NET CONTROL STATION
OF - OFFICER
OP - OPERATIONS
PB - PUBLISHING
RP - AMSAT REPEATER
SC - SPECIAL SERVICE CHANNEL
SP - SUPPORTING INDIVIDUAL OR GROUP
TM - TELEMETRY
VC - U. S. OR CANADIAN AREA COORDINATOR

MODIFIERS

AL - ALTERNATE
AS - ASSISTANT
JS - JAMSAT
MG - MANAGER
OB - OSCAR 8
P3 - PHASE III
PC - PACSAT
SN - SYNCART
UO - UOSAT

TO MAKE CHANGES, PLEASE CONTACT -

RICHARD ZWIRKO, K1HTV
12509 RANSOM DRIVE
GLENN DALE, MD 20769

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
AM		RADIO AMATEUR SATELLITE CORP. SUITE 601 850 SLIGO AVENUE	SILVER SPRING, MD 20910	OFFICE: (301)589-6062&4149 LAB: (301)344-6062 TELEX: 24-8566
AM		RADIO AMATEUR SATELLITE CORP. POST OFFICE BOX 27 WASHINGTON, DC 20044		OFFICE: (301)589-6062&4149 LAB: (301)344-6062 TELEX: 24-8566
AR, OB-OM, P3-BN	W1AW	AMERICAN RADIO RELAY LEAGUE HEADQUARTERS STATION, W1AW 225 MAIN STREET	NEWINGTON, CT 06111	WORK: (203)666-1541 WORK: (203)666-1547
OC	W7US	ALLEN, WILLIAM 8925 E. 5TH STREET TUCSON, AZ 85710		HOME: (602)299-4807 WORK: (602)745-3185
AS-OC	N3CAC	ALLEY, DEAN 7506 SANDALWOOD COURT HANOVER, MD 21076		HOME: (301)761-7115 WORK: (301)688-6856
MS	KOCY	AMSAT AMS-81 TRACKING SYSTEM MANAGER, BOB MCCAFFREY, KOCY 3913 29TH STREET	DES MOINES, IA 50310	
CA, MS		AMSAT BULLETIN BOARD SYSTEM C/O BOB DIERSING, N5AHD - MGR		CBBS: (512)852-8194 MON-THURS : 0500-2300UTC FRI-SUN : 0500-1200UTC
MS		AMSAT QSL BUREAU MANAGER, PERRY YANTIS 1850 LISLE	OBETZ, OH 43207	HOME: (419)589-6241
CA, MS		AMSAT SOFTWARE EXCHANGE PO BOX 27 WASHINGTON, DC 20044		WORK: (301)589-6062 TELEX: 24-8566
NC	/X2AJ	AMOUR, JAFFAR IMMEUBLE SONELGAZ PARC MIRMONT	BOUZARHEA ALGER ALGERIA	HOME: 79-10-85 WORK: 64-84-66 TELEX: 52-657
OC	KOGA	ANDERSON, GARFIELD A. 5820 CHOWEN AVENUE SOUTH MINNEAPOLIS, MN 55410		HOME: (612)922-1160
OC	KB5MZ	APPLEBY, WILLIAM 28 LINDA LANE LONG BEACH, MS 39560		HOME: (601)868-2055 WORK: (601)864-8054
NS		AMSAT - ARGENTINA C/O CARLOS HUERTAS, LU4ENQ BOX 9, SUC 1	01401 BUENOS AIRES ARGENTINA	HOME: 54-1-620-1474 WORK: 54-1- 30-5575
P3-CM, P3-IM	ZL1AUX	ASHLEY, IAN 5 WILLOUGHBY AVENUE HOWICK, AUCKLAND	NEW ZEALAND	HOME: 011-64-95-34-9210

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
SP	W3PZK	BALCOM, ROBERT 5706 SURREY STREET CHEVY CHASE, MD 20015		HOME: (301)652-4405
PC-DV	WA1DCP	BARLOW, PORT PO BOX 689 PUTNAM, CT 06260		HOME: (203)928-0138 TELEMAIL: PBARLOW
SP	N4LL	BEERMAN, RICHARD 1323 NAVAHO TRAIL ALABASTER, AL 35007		HOME: (205)663-7755 WORK: (205)252-7705
NS		BELSAT C/O WILLY GOOVAERTS, ON5JM MECHELSESTEENWEG 472	EDEGEM - ANTWERP B-2520 BELGIUM	
UC	WB8CQW	BENCE, THOMAS 930 GRACE STREET MANSFIELD, OH 44905		HOME: (419)589-6241
NC	TF3KB	BENEDIKTSSON, KRISTJAN BARMAHLID, 55 REYKJAVIK	ICELAND	
UC	K2KLV	BERNSTEIN, NORMAN P. 11 GEER AVENUE UTICA, NY 13501		HOME: (315)797-5497
UC	WD5CTQ	BIGELOW, RICHARD 18115 WILD WILLOW LANE KATY, TX 77449		HOME: (713)463-8611 WORK: (713)490-1161
P3-CM, P3-IM, PB	ZL1WN	BIGGAR, ROSS 6 PICKWICK PARADE HOWICK, AUCKLAND	NEW ZEALAND	HOME: 011-64-95-34-5868 TELEX: NZ-21647 "SPIRAAK"
AS-UC	K4SR	BISHOP, RICHARD 305 LAKEWOOD DRIVE MONETA, VA 24121		HOME: (804)297-5550
PB, NI	N6IE	BLUESTEIN, HARRY 5533 MOONLIGHT LANE LA JOLLA, CA 92037		HOME: (714)454-1098 WORK: (714)294-5982
NC	OZ5PK	BODTCHER-HANSEN, C. KLAKKEBJERG 77 DK-2750 BALLERUP	DENMARK	HOME: (45)02651211
UC	N3CEG	BRECHIN, MEL 3309 CARDENAS AVENUE BALTIMORE, MD 21213		HOME: (301)732-4753 WORK: (301)325-1700
UC	WB5PMR	BRINCKERHOFF, ALLEN 1507 SAN ANTON LANE LEWISVILLE, TX 75067		HOME: (214)436-4823 WORK: (214)634-1650

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
NC,PB,P3-MG-BN	G3AAJ	BROADBENT, RON 94 HERONGATE ROAD WANSTEAD PARK	LONDON E12 5EQ ENGLAND	HOME: 011-44-989-6741 TELEX: 897-073 "NAVAIDG"
OC	W1JSM	BROWN, DON 638 POST ROAD GREENLAND, NH 03840		HOME: (603)436-6745 WORK: (603)935-4800
OF,LA,FA	K9LF	BROWN, WILLIAM G. VICE PRESIDENT - SPECIAL PROJ BELL, BOYD & LLOYD	70 W. MADISON ST. #3200 CHICAGO, IL 60601	HOME: (312)234-5018 WORK: (312)372-1121 TELEX: (910)221-1220
DR,OF	W6SP	BROWNING, JOHN W. CHAIRMAN OF THE BOARD 6202 LOCHVALE DRIVE	RANCHO PALOS VERDES, CA 90274	HOME: (213)541-4997 WORK: (213)544-2543
OC	WA1ZOB	BUCKLEY, JAMES NW MAIN STREET EAST DOUGLAS, MA 01516		HOME: (617)476-7600
OC	WOII	BURGHARDT, STAN PO BOX #73 WATERTOWN, SD 57201		HOME: (605)886-3767 WORK: (605)886-7314
OC	WB9KMD	BUTLER, WILLIAM 310 SOUTH CAROLINE STREET HOMER, IL 61849		HOME: (217)896-2657 WORK: (217)384-8188
OC	VE4NI	CAMPBELL, DONALD J. 405 HOSMER BLVD WINNIPEG, MB	CANADA R3P 0H8	
NS		AMSAT - CANADA C/O JOHN M. HENRY, VE2VQ BOX 7306	VANIER, ONTARIO K1L 8E4 CANADA	HOME: (819)776-4221 WORK: (613)746-5920
SP	W3OTC	CARPENTER, ROBERT 12708 CIRCLE DRIVE ROCKVILLE, MD 20850		HOME: (301)762-5838 WORK: (301)921-3427
LA,MS,OC	K6PGX	CHALFIN, DR. NORMAN PO BOX #463 PASADENA, CA 91102		HOME: (213)681-4796 WORK: (213)354-6833 WORK: FTS# 792-6833
OC,OF,OP	K8OCL	CHAMPA, DR. JOHN J. AMSAT SENIOR VICE-PRESIDENT PO BOX 385	PIKETON, OH 45661	HOME: (614)772-6531 WORK: (614)289-2331 X2761 TELEMAIL: JCHAMPA
RP	WA9ZZZ	CHATTERS, GARY 9110 EIGHTH STREET SEABROOK, MD 20706		HOME: (301)459-8143 WORK: (301)459-0001
DR,OF,NI,P3-CM,PS-TM,CA	W3IWI	CLARK, THOMAS A. PRESIDENT 6388 GUILFORD ROAD	CLARKSVILLE, MD 21029	HOME: (301)854-3113 WORK: (301)344-5957

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
AR,MG-SC	WB9IHH	CLEARY, JAMES C/O ARRL 225 MAIN STREET	NEWINGTON, CT 06111	HOME (203)666-4035 WORK (203)666-1541
AS-OC,OB-CM	W3HV	CLEPPER, JR., WILLIAM 1070 ALCOMA STREET SHARON, PA 16146		HOME: (412)981-6044 WORK: (412)981-2750
AS-NC,CA	LU8E1C	COLLA, PEDRO YATAY 657 PB 'B' 01184 BUENOS AIRES	ARGENTINA	WORK: 54-1-86-6860
OF	W3IMZ	COLSON, JACK TREASURER 5609 OLDE OAK DRIVE	MOUNT AIRY, MD 21771	HOME: (301)831-7086 WORK: (301)953-7100 X7110 TELEMAIL: JCOLSON
OF,PC-DV,EG	KD2S	CONNORS, DEN ASST VP ENG, S/C SYSTEMS 80A NASHUA RD	E PEPPERELL, MA 01437	HOME: (617)433-5189 WORK: (617)459-5000 X6589
OC	W8DX	COTTON, RICHARD 5526 BUCKINGHAM ROAD DETROIT, MI 48224		HOME: (313)885-9310
OC	W7SK	COVINGTON, RALPH E. PO BOX #7750 RENO, NV 89510		HOME: (702)322-7988
OC	VE7XQ	CRAIG, TONY 20691 45A AVENUE LANGLEY, BC V3A 3G3	BRITISH COLUMBIA CANADA	HOME: (604)534-1276
AS-OC	KG5E	CRIMMINS, DARRELL B. 1847 SANDY RIDGE COURT CARROLLTON, TX 75007		
OC	K3WHC	CROSE, DR. STEPHAN 1018 NORTH GEORGE STREET YORK, PA 17404		HOME: (717)755-0516 WORK: (717)848-1302
P3-DV,P3-TM	W4POJ	DANIELS, RICHARD 3120 NORTH THOMAS STREET ARLINGTON, VA 22207		HOME: (703)243-7234 WORK: (202)453-2975
NC	CT4KQ	DA SILVA, SERAFIM M. ESTRADA DA AZENHA VISEU - 3500	PORTUGAL	HOME: 23084 WORK: 22761
P3-CA,PB	K2UBC/3	DAVIDOFF, MARTIN 13803 MANOR GLEN ROAD BALDWIN, MD 21013		HOME: (301)592-2860 WORK: (301)455-4377
NC	PY2BJU	DE CASTRO, JUNIOR T. RUA MACAUBAL NO. 119 CEP01256	SAO PAULO BRAZIL	WORK: 62-6240 WORK: 62-2692

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
P3-UP	KA1M	DESKUR, ANDREW J. 71 ADAMS AVENUE METHUEN, MA 01844		HOME: (617)688-0210 WORK: (800)225-0654 X7589
P3-CA,PB, UC	K2ZRU	DESKUR, KAZ PO BOX #11 ENDICOTT, NY 13760		HOME: (607)748-8028
NS		AMSAT - DEUTSCHLAND C/O ALEXANDER SCHUENING, DC7AS LUDOLFINGERWEG, 52	1 BERLIN 28 FEDERAL REPUBLIC OF GERMANY	HOME: 030-401-4411
MG-MS	WA3FOJ	DEVILBISS, JIM AWARDS MANAGER 915 PINE AVENUE	FREDERICK, MD 21701	HOME: (301)662-5784
CA,MS	N5AHD	DIERSING, ROBERT AMSAT SOFTWARE EXCHANGE MGR. 4129 MONTEGO STREET	CORPUS CHRISTI, TX 78411	HOME: (512)852-3196 WORK: (512)991-6810 X476
UB-CM,NI	W6ELI	DILLON, GEORGE 9850 GARFIELD STREET SPACE #134	HUNTINGTON BEACH, CA 92646	HOME: (714)968-7633
NC,MG-SC	WH6AMX	DITTMER, RICK CHIEF PACIF. REGION AREA COORD 7305 D ALOALO STREET	HONOLULU, HI 96818	HOME: (808)422-5691 WORK: (808)449-1150 TELEMAIL: RDITTMER
UC	W4DWN	DIXON, WALTER 820 NE 123 STREET MIAMI, FL 33161		HOME: (305)895-0398
NC	PY/CPK	DO O', EDMILSON R. CAIXA POSTAL 427 58100 CAMPINA GRANDE	PARAIBA BRAZIL	HOME: (083)321-1941 WORK: (083)321-2674
MG-P3-CM, PA,P3-IM	W1HDX	DUBOIS, JOHN MGR AMSAT GROUND STATION DEVEL 873 HILL ROAD	BOXBOROUGH, MA 01719	HOME: (617)263-3192 HOME: (617)263-7004
MG-NI	W8GGW	DUDLEY, WRAY 1617 WEST MCKAIG TROY, OH 45373		HOME: (513)339-2254
P3-CM,P3-IM	WOPN	DUNBAR, RON 6012 EAST SUPERIOR STREET DULUTH, MN 55804		TELEMAIL: RDUNBAR WORK: (218)723-3903 HOME: (218)525-3171 OR (218)525-2781
PC-DV	WB9FLW	EATON, PETER 35 NORSPUR RT-4 EDWARDSVILLE, IL 62025		HOME: (618)288-5432 TELEMAIL: PEATON

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
NC	KV4AD	FAGEOL, BERT BOX #2126 ST. THOMAS	VIRGIN ISLANDS 00801	HOME: (809)774-0358
SN-OV,CA	KL/GRF	FAIL, JOHN 6170 DOWNEY AVENUE LONG BEACH, CA 90805		HOME: (213)531-4852
LA,MS	KB4ZJ	FELLER, ARTHUR 6511 TUCKER AVENUE MCLEAN, VA 22101		HOME: (703)827-0270 WORK: (202)653-8531
NC	LU9MA	FONTANA, EUGENIO C. PATRICIAS MENDOCINA 262 5529 RODEO EL MEDIO	MENDOZA ARGENTINA	HOME: F. L. BELTRAN, MENDOZA, 49
P3-CM,P3-IM	WOLER	FOX, JOHN 321 109TH LANE NW COON RAPIDS, MN 55433		HOME: (612)757-3115 WORK: (612)482-2313
NS		AMSAT - FRANCE C/O GERARD FRANCON, F6BEG 69 RUE BATAILLE	69008 LYON FRANCE	
NC	DU6EG	GARCIA, DR. EDUARDO J. 31 LACSON STREET BACOLOD CITY	PHILLIPINES, 600001 THE PHILLIPINES	HOME: 2-44-22 WORK: 2-14-12
NC		GENTIL, MARC 3 RUELLE D'ARMORIQUE 78200 MAGANNVILLE	FRANCE	
AR,MS,PB,UB-MG-UP	WYKDR	GLASSMEYER, BERNARD PIONEER DRIVE GROVE BEACH	WESTBROOK, CT 06489	HOME: (203)669-4980
NC	ZP9AY	GODEFROID, ROBERT CAPITAN MIRANDA RUTA 6 ITAPUA	PARAGUAY	
NC	ON5JM	GOUVAERTS, WILLY MECHELSESTEENWEG 472 EDEGEM	ANTWERP B-2520 BELGIUM	
DR,MG-SC,MG-NC	G3IOR	GOWEN, PATRICK J A 17 HEATH CRESCENT HELLESDON, NORWICH	NORFOLK, NR6 6XD ENGLAND	HOME: 44-60-340-2554
UC	KL/JA1	GREENE, KEN 3719 WEST 80TH ANCHORAGE, AK 99502		HOME: (907)243-2576
SP	F8ZS	GROUAU, JEAN INSPECTUR GENERAL CNES IMMEUBLE HELIUS	RUE CH. BAUDELAIRE 9100 EVRY FRANCE	HOME: 33-(3) 077-5104 TELEX: A690701F (ATTN:D G/IG-J. GROUAU)

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
NC,P3-DV, P3-BN	HA5WH	GSCHWINDT, DR. ANDRAS TECH UNIV OF BUDAPEST (HG5BME) EGRI J.16 H-111	BUDAPEST HUNGARY	WORK: (1)869-231 TELEX: 861-225-931
NC,P3-BN	KP4AA	GUTIERREZ, CARLOS PO BOX 730, PUEBLO STATION CAROLINA, PR 00628		HOME: (809)752-6938 WORK: (809)791-2805
NS		HAMSAT BOX 882 5600 AW EINDHOVEN	THE NETHERLANDS	
NC	OE1HAB	HANN, HANS PO BOX 16 A 1164, VIENNA	AUSTRIA	
P3-DV,P3-CM,P3-IM, AL-DR	KE3D/ZS1FE	HARDMAN, GORDON BOX 8005 SUITE #281	BOULDER, CO 803068005	HOME: (303)494-3046 WORK: (303)442-8866 TELEMAIL: GHARDMAN
DR,SN-DV	VE2VQ	HENRY, JOHN M. BOX 7306 VANIER, ONTARIO	K1L 8E4 CANADA	HOME: (819)776-4221 WORK: (613)746-5920
RP,UC	WA5FXE	HICKEY, WILLIAM PO BOX 912 BOWIE, MD 20715		HOME: (301)464-3994 WORK: (202)282-0298
PB,UC	W4PID	HILL, ROY O. 4051 SKYLAND DRIVE KINGSPORT, TN 37664		HOME: (615)246-4515 WORK: (615)229-2721
AR,SP	W6EJJ	HOLLADAY, JAY ASSC CHAIRMAN 5128 JESSEN DRIVE	LA CANADA, CA 91011	HOME: (213)790-1725 WORK: (213)354-7561 TELEMAIL: JHOLLADAY
SP	W3QBC	HOOK, WILLIAM A. 4008 JEFFREY STREET WHEATON, MD 20906		HOME: (301)942-6014 WORK: (301)496-6694
NC,PB	CE6EZ	HUCKE, RALF CASILLA 145 TEMUCO,	CHILE	HOME: 35983 WORK: 35083 TELEX: 6700? CL
MG-NC,PB, MG-SC	LU4ENQ	HUERTAS, CARLOS CHIEF SO. AMER. AMSAT COORD BOX 9 SUC 1	01401 BUENOS AIRES ARGENTINA	HOME: 54-1-620-1474 WORK: 54-1- 30-5575
NS	IWØBAY	AMSAT - ITALIA CAPUANO, LUIGI PO BOX 014	I-04026 MINTURNO (LT) ITALY	081-881-8144 081-861-2522
UC	WA7ZBU	JACOBS, LARRY 3123 WEST HAYDEN WAY SALT LAKE CITY, UT 84118		HOME: (801)969-6914 WORK: (801)363-1544 X369

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
P3-DV	WD4FAB	JANSSON, RICHARD 1130 WILLOWBROOK TRAIL MAITLAND, FL 32751		HOME: (305)644-9008
NC,PB	PA0DLO	JANSSEN, NICO VOORVLINDERSTRMT-65 5641 DL	EINDHOVEN THE NETHERLANDS	
NS		JAPAN - AMSAT C/O S. MORIMOTO BOX 117	TOKYO CENTRAL, 100-91 JAPAN	
PC-DV	WA7GXD	JOHNSON, LYLE 3034 N. JACKSON TUCSON, AZ 85719		HOME: (602)574-0809 WORK: (602)746-9127
MS	WB0GAI	JOHNSON, ROGER AMSAT VIDEO-TAPE LIBRARY 1637 36TH AVE. CT.	GREELEY, CO 80631	HOME: (303)330-0735
P3-CA	N5KR	JOHNSTON, WILLIAM 1808 POMONA DRIVE LAS CRUCES, NM 88001		
AS-UO	KH6U	JONES, ROBERT W. 460-353 KUMOO LOOP KANEOHE, HI 96744		HOME: (808)247-2510
UO	W4DAQ	JORDAN, WILLIAM (MACK) PO BOX DRAWER X DEMOPOLIS, AL 36732		
SP	KA3COK	KABRAN, BYRON 8802 CUNNINGHAM DRIVE BERWYN HEIGHTS, MD 20740		HOME: (301)474-4377 WORK: (301)474-9827
P3-DV,P3-IM,UF,EG	KA9Q	KARN, PHILIP ASST VP ENG, SYSTEMS ANALYSIS 25-B HILLCREST RD	WARREN ,NJ 07060	HOME: (201)561-2970 WORK: (201)582-6638 TELEMAIL: PKARN
PB,P3-IM	4X6CZ	KASSER, JOE RAMOT 976 JERUSALEM	ISRAEL	HOME: 972-2-886-971 WORK: 972-2-810-827
PC-DV	WA3ZIA	KAYSER, LARRY 85 HELENA AVENUE OTTOWA, ONT K1Y3M9	CANADA	HOME: (613)729-7992 WORK: (613)239-2089 TELEMAIL VIA H. MAGNUSKI
AS-UO	NZ4Q	KEARNEY, TIMOTHY 235 WINDY COURT LILBURN, GA 30247		HOME: (404)925-3141 WORK: (404)925-5905
P3-DV,DR,UF	W3GEY	KING, JAN VICE PRESIDENT - ENGINEERING 1308 KILKENNY STREET	BOULDER, CO 80306	HOME: (303)665-9655 WORK: (303)442-8866 TELEMAIL: JKING

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
NC	OH2XN	KINNUNEN, ULLI S. ALAKARTANUNTIE 6B49 SF 02360 ESPOO	FINLAND	HOME: 358-0-801-6583 TELEX: 121394 ITIX SF ATTN: PRIMELEC
FA	KA5EIM	KLETT, TAYLOR ROUTE 1 BOX 421-B	HUNTSVILLE, TX 77340	HOME: (409)295-3517 WORK: (409)294-1075
AR,ED	WB2IRN	KLUGER, LEO C/O ARRL 225 MAIN STREET	NEWINGTON, CT 06111	WORK: (203)666-1541
AS-UC	K8MU	KOZIEL, LAWRENCE 42509 PARKHURST PLYMOUTH, MI 48170		HOME: (313)420-0786
UC	WA4DDH	LATIMER, WILLIAM BOX #994 MARIETTA, GA 30061		HOME: (404)926-4053
UC	WOCA	LAUB, NICK RFD #1 BACKUS, MN 56435		HOME: (218)947-3501
AM	N2CF	LAZZARO, WILLIAM AMSAT GENERAL MANAGER 4424 HIGHBORO DRIVE	MT. AIRY, MD 21771	HOME: (301)829-9607 WORK: (301)589-4149 WORK: (301)589-6062
UC	K9PVW	LEARNER, K U 4012 SOUTH HARDEBECK ROAD KOKOMO, IN 46901		HOME: (317)453-2947 WORK: (317)459-7002
UC	WA7VKC	LEONARD, DAVE 1980 HILLCREST WEST LINN, OR 97068		HOME: (503)636-2379
NC,PB	XE1IU	LIBERMAN, DAVID BOSQUE, SAYULA 22 MEXICO 10, E DO. DE MEX.	MEXICO	HOME: (905)589-3994 WORK: (905)576-5188 WORK: (905)576-5198
MG-BN	W3BWU	LIPS, ED AMSAT BULLETIN STATION MGR. 3302 HAZELHURST	PITTSBURGH, PA 15227	HOME: (412)882-0365 WORK: (412)391-4197
NC	EA3LL	LLAGUSTERA, JOSE M. APT #310 REUS (TARRAGONA)	SPAIN	
UP,NI,UP	KU5I	LOUGHMILLER, DOUGLAS VP, OPERATIONS 2335 SIMPSON STREET	PARIS, TX 75460	HOME: (214)784-0194
P3-CA	W8MQW	MACCLUER, CHARLES R. PO BOX 1858 EAST LANSING, MI 48823		HOME: (517)651-6187 WORK: (517)353-6339

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
MG-SC	KA6M	MAGNUSKI, HANK AMICON SSC COORDINATOR 311 STANFORD AVENUE	MENLO PARK, CA 94025	HOME: (415)854-1927 WORK: (415)856-7421
OC	WB2LEI/4	MALIN, JERRY 709 MADRAS LANE CHARLOTTE, NC 28211		
MG-SC, OC, PB	N1DM	MALLOZZI, DOM 26 CAREY STREET WATERTOWN, MA 02172		HOME: (617)924-7520 WORK: (617)899-8400 X2919
NC, PB	I8CVS	MARINI, DOMENICO VIA A. DE GASPERI 131 80059 TORRE DEL GRECO	NAPLES ITALY	HOME: (081)881-8144 WORK: (081)861-2522
AM, P3-DV		MARK, MARIE 891 ORBIT LANE LANHAM, MD 20801		HOME: (301)577-9187 WORK: (301)344-7780
AS-OC	WA0WPJ	MARTIN, CRAIG 1236 EWING KANSAS CITY, MO 64126		
OC	W4PJ	MATHEWSON, TED 1525 SUNSET LANE RICHMOND, VA 23221		HOME: (804)355-5118
P3-CA, OC, NI	K0RZ	MCCAA, JR., WILLIAM PO BOX #3214 BOULDER, CO 80607		HOME: (303)499-1936 WORK: (303)673-4693
OC	WB4ZXS	MCDONALD, JOHN D. 1511 PINEDA AVENUE COCOA, FL 32922		HOME: (305)632-6667 WORK: (305)254-2026 WORK: (305)259-8998
NI	N4HY	MC GWIER, ROBERT 29 THEBE STREET PROVIDENCE, RI 02904		HOME: (401)273-7248
NI, MG-OC	W0CY	MC KIM, JIM CHIEF US AREA COORDINATOR 1404 SOUTH 10TH STREET	SALINA, KS 67401	HOME: (913)827-2927
AS-OC, MS	W0VU	MEANS, EDWARD SOLAR CELL CERTIFICATES 212 NORTH FARRAGUT	COLORADO SPRINGS, CO 80909	WORK: (303)471-1277
P3-DV, P3-CM, P3-IM	DJ4ZC	MEINZER, KARL HUEHENWEG, 38 D-355 MARBACH	HESSEN FEDERAL REPUBLIC OF GERMANY	HOME: 011-49-64-21-32605 WORK: 011-49-64-21-83550 TELEX: 841-482-372
MG-BN, ED, OC	W2GN	MERRY, FRED 35 HIGHLAND DRIVE EAST GREENBUSH, NY 12061		HOME: (518)477-4990

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
NS		AMSAT - MEXICO C/O DAVID LIBERMAN, XE1TU BOSQUE, DE SAYULA, 22	MEXICO 10, DF MEXICO	
NC	VU2IJ	MISTRY, JIMMY H. NORMOS - 16 PERRYCROSS RD BANDRA	BOMBAY, 400050 INDIA	
CA,MS	WORUE	MONTAGUE, JOHN SOFTWARE LIBRARY (HP/TI) BOX 541	WILLERNIE, MN 55090	HOME: (612)426-5673 WORK: (612)941-5464
NC	JA1NEI	MORIMOTO, S. BOX 117 TOKYU CENTRAL, 100-91	JAPAN	
UC	K/ENE	MOSS, RONNIE RT 3, BOX #400 REXBURG, ID 83440		HOME: (208)356-2359
NC	YV5ZZ	MOELLER, EDGAR APARTADO /6093 CARACAS, 107	VENEZUELA	
PB	W1XI	MYERS, ROBERT 221 LONG SWAMP ROAD WOLCOTT, CT 06716		HOME: (203)879-0561 WORK: (203)879-1869
P3-1M,CA, J5-DV	JR1SWB	NAKAYAMA, MIKI 3-9-14 HIGASHINAKANO NAKANO - KU	TOKYU 164 JAPAN	HOME: 03-371-2676 TELEMAIL: MNAKAYAMA
UC	W1UA	NEARY, JON STARR ACRES MAPLEWOOD, ME 04052		HOME: (207)783-8075
NS		AMSAT - NEDERLAND C/O J P VAN DER FLUIT, PAOKTF GROENSVOORDE 148	WADDINXVEEN THE NETHERLANDS	
UC,NI,PB, CA	KE0I	NICKELS, ROBERT 802 SOUTH MYRTLE STREET KIMBALL, NE 69145		HOME: (308)235-4213 WORK: (308)235-4645
UC	KH6IJ	NOSE, KATASHI 4207 HUANUI STREET HONOLULU, HI 96816		HOME: (808)734-1463
SP	JA2PK1/W6	OKAMOTO, TAC 191 PINESTONE IRVINE, CA 92714		HOME: (714)857-0505 WORK: (714)678-0417
NC	TG9SU	OLIVOTTO, ROBERTO S. PO BOX 144-A CIUDAD DE GUATAMALA	GUATAMALA	HOME: (2)65363 WORK: (2)913723 WORK: (2)912147

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
OB-OM,OO	VE3HCR	UMAN, DAVID 330 WINIFRED DRIVE KESWICK	UNTARIO, L4P 3B5 CANADA	HOME: (416)476-5973 WORK: (416)476-4321 WORK: (416)476-2000
NC	OK3AU	URAVEC, ANDRE J. UL SLOBODY 31 KOSICE 04011	CZECHOSLOVAKIA	HOME: 095-420-304
NC	5B4KP	PANDEHIS, CHARLES PO BOX #1152 NICOSIA,	CYPRUS	
OO-PB	WA4SIR	PARISE, RONALD 15419 GOOD HOPE ROAD SILVER SPRING, MD 20904		HOME: (301)384-0250 WORK: (301)344-8874
NC	9J2KL	PATEL, KANUBHAI PO BOX #30233 LUSAKA	ZAMBIA	HOME: 254045 WORK: 214282 TELEX: ZA 42421 "CAPCO"
OO	W1PV	PAULSEN, C R (SKIP) 19 WESTVIEW DRIVE DANBURY, CT 06810		HOME: (203)792-2774 WORK: (203)358-3117
P3-CA,PB	W2GFF	PEACOCK, RICHARD 9 ANDREA DRIVE SETAUKET, NY 11733		HOME: (516)941-4943 WORK: (516)595-4897
MS	KA1DF	PEARSE, GEORGE B. 84 BRIGHAM HILL ROAD GRAFTON, MA 01519		HOME: (617)839-2933 WORK: (617)376-2947 TELEX: 95-1853 "PRS PRSN MILS"
NC	LU8DYF	PENINI, NORBERTO PACHECO 3346 01636 OLIVOS	ARGENTINA	WORK: 54-1-795-4685
P3-IM	KBONR	PHILSTROM, RICHARD 61 NE 90TH LANE BLAINE, MN 55434		
AR,ED,PB, MG-SC	WB1EYI	PLACE, STEPHEN C/O ARRL 225 MAIN STREET	NEWINGTON, CT 06111	HOME: (203)667-8955 WORK: (203)666-1541
BN	W1NU	POLITI, VIC 69 FLAX ROAD FAIRFIELD, CT 06430		HOME: (203)259-4655 WORK: (203)771-3582
OO	W11AS	POWERS, TED 40 MASSACHUSETTS COURT FALMOUTH, MA 02540		WORK: (617)548-1611
PC-DV	NK6K	PRICE, HAROLD 1211 FORD AVENUE REDONDO BEACH, CA 90278		HOME: (213)376-3147 TELEMAIL: HPRICE

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
SN-DV,MS, CA		PROJECT OSCAR, INC. PO BOX # 1136 LOS ALTOS, CA 94022		
DR,OC,PB, CA	W6XN	PRUNKU, JOHN 230 HAWTHORNE ROAD LOS ALTOS, CA 94022		HOME: (415)941-6988 WORK: (415)424-2073
MS	WA3DMF	RADER, WALT QSL & LISTENER REPORTS 3702 ALLISON STREET	BRENTWOOD, MD 20722	HOME: (301)864-2398
PC-DV	WD0ETZ/5	REED, WILLIAM 3110 AFTON DRIVE CARROLLTOWN, TX 75007		HOME: (214)492-7508 WORK: (214)830-7735 TELEMAIL: WREED
OC	VE6AK	REID, GORDON PO BOX #11721 EDMONTON	ALBERTA T5J 3K8 CANADA	
P3-CM,P3-IM	W6PAJ	REYMANN, SKIP PO BOX 374 SAN DIMAS, CA 91773		HOME: (714)599-3936
NC	9M2CR	RICHARDS, COLIN 73 JALAN PANTAI PORT DICKSON	MALAYSIA	HOME: 06-791-834
OF,PB,NI	WA2LQQ	RIPORTELLA, VERN EXECUTIVE VICE PRESIDENT BOX 177	WARWICK, NY 10990	HOME: (914)986-6904 WORK: (201)284-2352
PB,CA	ZS1BI	ROBERTS, GREG PO BOX 9 OBSERVATORY, 7935	SOUTH AFRICA	HOME: 537124 WORK: 551341 TELEX: 906-57-20309
OC,PB	W9MXC	ROBERTS, LARRY H. 3300 FERNWOOD ALTON, IL 62002		HOME: (618)465-2735 WORK: (314)233-4370
NC	VK3ACR	ROBINSON, CHARLES J. 338 DORSET STREET BORONIA	VICTORIA 3155 AUSTRALIA	
P3-DV,MS, OF	W2FPY	ROBINSON, STEVE ASST VP ENGINEERING, R&D 47 SERPENTINE ROAD	RINGWOOD, NJ 07456	HOME: (201)835-1152 WORK: (914)351-5277
OC	K1DS	ROSEN, RICK 321 TABER AVENUE PROVIDENCE, RI 02906		HOME: (401)272-5626 WORK: (401)331-3000
FA	K4YV	ROSNER, ROY 12001 TURF LANE RESTON, VA 22091		HOME: (703)860-1389 WORK: (703)442-1744

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
OC	W2HG	ROSSI, BOB 114 AILEE DRIVE ROCHESTER, NY 14626		HOME: (716)225-6754 WORK: (716)458-8000 X1266
NC,CM,IM	ZL1WB	ROWLINGS, BRUCE 6 MASON STREET ONEHAHI	WHANGAREI, NORTHLAND NEW ZEALAND	HOME: 61312 WORK: 81299
NC	TI2NA	ROY, ERIC BOX #661 SAN JOSE,	COSTA RICA	
OC	W7RZY	ROYLANCE, HARRY 216 SOUTH M STREET LIVINGSTON, MT 59047		WORK: (406)222-0655
PB	W4OWA	RUEDISUELI, ROBERT 1537 CROWELL ROAD VIENNA, VA 22180		HOME: (703)759-5730 WORK: (202)457-2920
OC	W3KH	RUPERTO, E. F. (BUCK) RD 1, BOX 366 WEST ALEXANDER, PA 15376		HOME: (412)663-5004 WORK: (412)644-5412
AM,MG-UP		SARAGOVITZ, MARTHA CORPORATE SECRETARY 1722 19TH STREET, NW	APARTMENT 803 WASHINGTON, DC 20009	HOME: (202)387-6040 WORK: (301)589-6062
OC	NOAN	SCHIERS, ROBERT BOX 1024 - I S U STATION AMES, IA 50010		HOME: (515)434-2368
OC	W9JOV	SCHROEDER, JOSEPH BOX #406 GLENVIEW, IL 60025		HOME: (312)724-8816 WORK: (312)724-8831
NI,OB-CM, OC	W6CG	SCHULTZ, BUD 3050 WEST BALL RD #154 ANAHEIM, CA 92804		HOME: (714)826-4850
NI	N3AR	SCHWENDI, RONALD J. BOX 149A SYCAMORE ROAD RD #1	DOUGLASSVILLE, PA 19518	HOME: (215)326-6336 WORK: (215)921-4115
MS	K3PNL	SIEBERT, FRED 8357 RESERVOIR ROAD FULTON, MD 20759		HOME: (301)776-1947 WORK: (301)344-7785
OC	WB5YDE	SINGER, MICHAEL PO BOX #118 SHREVEPORT, LA 71161		HOME: (318)861-7348 WORK: (318)635-2076
NC	SM5KUX	SKARSFELL, SIGGE BOX 27 S-601 03 NORRKOPING	SWEDEN	

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
P3-IM	WD0EEL/4	SKOOG, JAMES 1265 NW 7TH STREET BOCA RATON, FL 33432		HOME: (305)395-4575 WORK: (305)994-8800 X3334
VC	KA7APJ	SMITH, JIM 5717 N. E. 56TH SEATTLE, WA 98105		HOME: (206)523-6167 WORK: (206)323-5000
P3-CM, P3-IM	VE1SAT	SMITH, RANDALL BOX 2194 MEDLEY,	ALBERTA T0A 2M0 CANADA	HOME: (403)594-6446 WORK: (403)594-8870
PB	KW2U	SUDERMAN, ROGER 43 COUNTRY SQUIRE OLD TAPPAN, NJ 07675		HOME: (201)666-2430 HOME: (201)666-2870 WORK: (212)674-8500
PA, NT	W2RS	SUIFER, RAPHAEL 60 WALDRON AVENUE GLEN ROCK, NJ 07452		HOME: (201)447-5472 WORK: (212)692-2792
NC	YU2IS	SULI, IULIUS STR. IASI 1 1900 TIMISUARA	ROMANIA	HOME: (961)37781 WORK: (961)13237
AS-MG-VC	WA6VGS	SUMERS, JACK DEPUTY CHIEF - US AREA COORD. PO BOX #49751	LOS ANGELES, CA 90049	HOME: (213)478-1717 WORK: (213)820-1234 WORK: (800)421-6631
VC	VE2ASL	SUNDACK, ROBERT 260 BELLERIVE ST. LUC	QUEBEC J0J 2A0 CANADA	HOME: (514)348-9425 WORK: (514)347-5301
NS		AMSAT - SOUTH AFRICA C/O HANS VAN DE GROENENDAAL NORTH MEAD, 1511	SOUTH AFRICA	
P3-MG-ED	ZL1MU	SPACKMAN, IRVING 78 WAIMA CRESCENT TITIRANGI CRESCENT	NEW ZEALAND	
AS-VC	KC8UR	SPIEGEL, TONY R. 503 NORTH MAIN STREET MT. VERNON, OH 43050		HOME: (614)392-7586 WORK: (614)397-1010 X328
MG-MS	W2BXA	STEVENSON, BEN EQUIPMENT LOAN MANAGER 50 SYCAMORE	COLONIA, NJ 07067	HOME: (201)388-7700
VC	WB1N	STEWART, CLARK 104 HENRIETTA STREET RAVENSWOOD, WV 26164		HOME: (304)273-4680
AS-VC	N5BRG	STRICKLIN, ROBERT S. 2262 WOODCREEK CARROLLTON, TX 75006		

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
NC	VU2UV	SUBRAMANIAN, GP CAPT V LRDE, HIGH GROUNDS BANGALORE 1	INDIA 560001	WORK: 27226 TELEX: 084 5288
NC	SP9DH	SUCHETE, ADAM SKR. POCZT 73 32-065 KRZESZOWICE	POLAND	HOME: 210-71
AS-OC	W7FF	SWAFFORD, JAMES 5906 WEST MIRAMAR DRIVE TUCSON, AZ 85715		HOME: (602)298-7793 WORK: (602)746-6574
BN	KA1FCP	SWANSON, ARTHUR 14 WYMAN ROAD CAMBRIDGE, MA 02138		HOME: (617)492-5231 WORK: (617)254-9867
AR,SP	K1ZZ	SUMNER, DAVID C/O ARRL 225 MAIN STREET	NEWINGTON, CT 06111	WORK: (203)666-1541
OB-OO-CM, OO-MG-OP, PC-DV	G3YJO	SWEETING, MARTIN DEPT OF ELECTRICAL ENGINEERING UNIVERSITY OF SURREY	GUILDFORD SURREY GU2 5XH ENGLAND	HOME: 011-44-483-893860 TELEX: 851-859-331 WORK: 011-44-48-37-1281 X755
OC	VE1KG	SZPILFUGEL, SERGE PO BOX #25 ARMDALE HALIFAX	NOVA SCOTIA CANADA	
SP		- TAPR - TUCSON AMATEUR PACKET RADIO PO BOX 22888	TUCSON, AZ 85734	
NC	LZ1AB	TERZIEV, VASSIL PO BOX 311 SOFIA	BULGARIA	
NC	OD5GR	TRAD, GEORGE TRAD BUILDING SURSUCK STREET	TABARIS BEIRUT LEBANON	HOME: 337-012
RP,FA	W3XO/W3KMV	TYNAN, WILLIAM 1362 CULEFAIR DRIVE SILVER SPRING, MD 20904		HOME: (301)384-9138 WORK: (301)953-7100 X3002 TELEMAIL: BTYNAN
NS		AMSAT - UK C/O RON BROADBENT, G3AAJ 94 HERONGATE ROAD	WANSTEAD PARK LONDON E12 5EQ ENGLAND	HOME: 011-44-989-6741
NC	PA0KTF	VAN DER PLUIJ, J. P. GROENSVOORDE 148 WADDINXVEEN	THE NETHERLANDS	
NC	SV1AB	VERNARDAKIS, GEORGE 7 ANDIXEOS STREET NEA KIFISIA	ATHENS GREECE	HOME: 8015750 WORK: 5711128

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
NC	4X4MH	VILENSKY, DR. ALEX PO BOX #6342 HAIFA	ISRAEL	HOME: 04-332303 WORK: 04-533111 X210
RP,P3-IM	WA4SNL	VIETS, RON PO BOX 277 COLONIAL BEACH, VA 22443		HOME: (804)224-0669 WORK: (703)663-8057
PC-SP		- VITA - VOLUNTEERS IN TECH. ASSISTANCE ATTN: GARY GARRIOT, WA9FMQ	1815 NORTH LYNN STREET ARLINGTON, VA	WORK: (703)276-1800
NC	HB9UP	VOGEL, TED CH. DU LEMAN, PREVALLON CH. 1297 FOUNEX	SWITZERLAND	HOME: (022)/64242
UP	WORPK	WALLIO, RALPH AMSAT ASST VP OPERATIONS RR4	INDIANOLA, IA 50125	HOME: (515)961-6406 WORK: (515)961-6995
UC	K1LJL	WARLEY, STEPHEN 63 MOORE DRIVE BURLINGTON, VT 05401		WORK: (802)658-3674
P3-CA,UC	W0SL	WELCH, ROY D. 908 DUTCH MILL ROAD MANCHESTER, MO 63011		HOME: (314)391-1127 WORK: (314)247-5844
NS		WIA - PROJECT AUSTRALIS C/O DAVID HULL, VK3ZDH 3 OLIPHANT COURT	MULGRAVE 3170, VICTORIA AUSTRALIA	HOME: 011-61-3-560-9194 WORK: 011-61-3-524-2257
IM	K9CIS	WIESENMEYER, FRANK 2181 SUMMIT COURT DECATUR, IL 62526		HOME: (217)428-9865
UC	VE5XU	WIGHTMAN, GORDON 3637 VICTORIA AVENUE REGINA	SASKATCHEWAN S4T 1M4 CANADA	HOME: (306)352-0306
UB-CM	K3NW	WILLIAMS, NORMAN RFD 4 BOX 411 FLEETWOOD, PA 19522		HOME: (215)944-0101 WORK: (215)921-6527
CA,MS	WD9ICG	WIMAN, JAMES PO BOX 338 ASHMORE, IL 61912		HOME: (217)349-8820
PB	KB2M	WINARD, HAROLD 30 W UNION TURNPIKE APARTMENT BB	WHARTON, NJ 07885	HOME: (201)361-6478 HOME: (201)843-0550
UC	K9DID	WRIGHT, BEN 1024 WHITTIER DRIVE APPLETON, WI 54911		HOME: (414)739-8958

TITLES	CALLSIGN	ADDRESS	ADDRESS	PHONES
UC,MG-MS	WB8UIH	YANITS, PERRY AMSAT QSL BUREAU MANAGER 1850 LISLE	UBETZ, UH 43207	HOME: (614)491-1498
DR,MG-NC, PB,MG-SC, JS-DV	JA1ANG	YUNEDA, HARUU 15-1305 SHIMUUMA 2-CHUME-26	SETAGAYA-KU TOKYU 154 JAPAN	HOME: 03-410-2253 WORK: 03-544-5056 TELEX: 781-25-22287 "DENISU"
UC	W1KK	ZAVARELLA, ARTHUR 1702 MAIN STREET AGAWAM, MA 01001		HOME: (413)786-9115
NC	OA4BR	ZELLUN, JAMES NICOLAS DE RIVERA 890 SAN ISIDRO	LIMA 27 PERU	HOME: 417343 WORK: 677777
MG-PJ-SP	K1HIV	ZWIRKO, RICHARD 12509 RANSOM DRIVE GLENN DALE, MD 20769		HOME: (301)464-2133 WORK: (202)755-4414

ADDENDUM

UC	W8PGP	BURGRAFF, RICHARD 988 PROSPERITY ROAD WAVERLY, OH 45690		HOME: (614)947-5483

What's in a Layer?
or
Why Layer Three is not Linking

by Lynn W. Taylor, WB6UUT

I have been reading a lot of papers recently discussing some planned hardware, and some "wish lists" for layer 3 (and higher) protocols. In most of these, it seems to me that the authors have drifted from the goal of defining what should be done at the Communications Subnet level (layer 3) of the ISO model. To explain this level as I understand it, I am going to present an analogy, discuss the issues I feel are and aren't important, and suggest why layer 3 and linking should be considered together. Finally, I will present my layer 3 "wish list."

As a brief review, layer 1 (physical) gives us a communications media or channel. Our specific choices on this later are Radio, HDLC, Bell 202 and 1200 baud; it does not deal with error rates or channel sharing.

On layer 2, we take our channel resource and split it up (in time) into 'virtual' channels, and we take steps to insure a (nearly) error free channel. Our specific layer 2 is AX.25, which defines a Local Area Net, and provides a means to extend the LAN where signal propogation is inadequate to allow the most distant users to communicate (disipeating). In the Los Angeles/San Diego LAN, the most distant users are over 120 miles apart; the user must have some knowlege of the network topology (who can hear whom) in order to communicate with other users.

Another network worth considering is the telephone system. In this network, we have a physical level (baseband audio on wires), a data link layer (the local office switch), and a good example of a communications subnet layer. Layer 1 is handled by wire. On layer 2, 10,000 users (which share a prefix) can be directly connected together by switches in a single exchange. On layer 3, things get more complex.

While only a short distance apart, it is not possible for my phone (497 prefix) to be connected to my parents (494 prefix); we are in seperate "local networks" or local exchanges. In this trivial case (both exchanges are in the same building), my exchange selects a 'trunk' which connects it to the other exchange, and then on to the call's destination.

In the case of a longer call (from my home in Southern California to Pete Eaton in Saint Louis, for example), I "invoke" a long range network (which my exchange knows how to access), and trunks are selected connecting to various switching centers, into Pete's exchange, and on to Pete's phone.

The important thing to note here is that, as far as I can tell, my phone can directly be connected to any phone in my local dialing area (a geographically large LAN), or any other phone in the world -- without my knowing (or even being able to find out) which trunks, exchanges, routing centers, etc. are involved. In other words, the task of the communications subnet layer is to make it appear that every station in the net can be directly connected to every other.

As a user in the LAN, what I should be able to do is exactly the same as when I dial my telephone -- connect to any other station by simply specifying the call sign of that station. The connect may fail because the destination node is down, busy, or simply unreachable. In a seperate paper, I have suggested a decentralized mechanism which would allow dynamic routing of packets as the network changes -- other algorithms are possible, including centralized and hybrid networks. What ever method is finally chosen, it should appear to the user that every station in the net can talk directly to every other node in the net.

Notice that many of these statements are as valid for a long-distance network (AMICON) as for a local network, and perhaps even mre valid. It should not be necessary for me to specify that my data be transferred via Los Angeles, Las Vegas, Salt Lake City, etc. to get to Saint Louis; especially if the route via San Diego, Tucson, Taos, Houston, etc. is less congested, or if a critical node is down along the other route.

I am concerned when other issues start "invading" the communications subnet, such as non-connect communications, such as sattelite (PACSAT) routing, and mail-type services. In the case of message traffic, Bulletin boards and PACSAT gateways can provide the necessary store-and-forward services. In order to incorporate this in a protocol, w must deal with such issues as how to store this data (provide some nodes with lots of memory?), how to access this distributed database, and how long to keep these messages around. In my opinion, this is an application of the network best dealt with at the application level (layer 7).

In the phone system, special procedures are necessary to access the long-range network (dialing '1'). I don't think it is unreasonable to set up a gateway to a long-haul network, and require the user to connect to this station to access distant networks. A question here is, do I want my TNC to indicate that I am connected to the distant station, or is it OK or me to be connected to the gateway itself. A good option here might be to connect to the linker, give it the call I want to talk to, and disconnect, allowing it to connect (at layer 3) to me when the path is established.

In other words, we want a communications subnet to be usable without any specialized knowlege of it's topography. In order to reach this goal, layer 3 is concerned with routing; it does not state whether we are extending our LAN, or linking distant networks.

While these are seperate issues, I don't think one can be considered without the other. On one hand, linking LAN's is much more difficult if you must give detailed routing information; some kind of layer 3 is almost essential for the long-haul net On the other hand, the LAN layer 3 would require each node to have some information about the network it's in; if a long-haul gateway knows who it can reach in it's LAN, it can be queried for a specific station -- this query could provide a "directory assistance" function. Using "area codes" suggests that a "packet directory" would need to be published. A scheme allowing a query throughout the long-haul network would handle this case, and also allow me to travel to another area and receive connects through the appropriate gateway.

Now that I have presented some of my thoughts on the topics of linking and layer 3, I would like to present my "wish list." I would like to see a communications subnet layer running on the TNC in the LAN, allowing me to connect to any station in the net by requesting a connect to that station. I want the algorithm to be able to handle changing topography (due to stations going on/off line, or changing propogation and dynamically re-route my packets; this does not allow for a user-specified routing, since the network has the authority to change the routing. I want a similar capability to exist in the long-haul network, plus a 'directory assistnce' capability allowing me to access a station by call sign without knowing exactly where he is in the net.

I think this is attainable using present hardware. As I discussed in my previous paper ("A Proposed Layer 3 Routing Algorithm"), I feel it is possible to have dynamic routing in a connection environment. The tables necessary to handle this in the LAN make the necessary data available to the long-haul net. This will allow a smoothly operating local net, and an easily accessable long-haul network which is fairly tolerant of failures; it should also be simple enough to implement.

Version: 1.0
Date: 20-Mar-1984

This document is a first draft for the design requirements for an amateur packet radio network. All areas of this document are preliminary and subject to revision. This document will start to address some of the key issues of a packet radio network. The book "Computer networks" by Andrew Tanenbaum[1] is usefull in understanding the terminology used in this document and for understanding the ISO networking model. Early work on the local area aspect of this subject can be found in "QST.81.12.06.0.KA6M."[2]

The first thing to consider is: What purpose will the network perform? The answer is not obvious. If we assume the primary goal of this network will be to provide world wide automatic message service on a public and private level over amateur radio, we have a place to start.

With this top level purpose in mind, it would appear that the organization of the USENET network might be applicable. Based entirely on outward appearances, USENET is based on the UUCP protocol (Unix to Unix communication protocol) and works primarily over phone lines. USENET allows for broadcasting messages to usergroups, sending mail to specific users and archiving information in central sites. This seems a reasonable set of utilities to base an amateur communications network on.

Some places that USENET and the packet network will probably differ: USENET used static routing of messages. The sender is required to know the addresses of all the nodes between himself and his destination. USENET assumes all nodes to be intelligent store and forward stations. Other assumptions are unknown. At this point, any formal references on USENET would be appreciated.

Before discussing specific requirements of a packet radio network, let us first discuss some of the non-goals. One service some networks provide is load sharing. If one server requires additional processing power, the tasks can often automatically be offloaded to other servers in the network. In this case the term server indicates a higher level of entity than a node or station. I suspect load sharing to be a non-goal of this network. Another possible non-goal might be resource sharing other than disc space. Although it is possible that a local packet radio group might want to set up a letter quality printer at a central site for all members to use over the air, this should be considered a higher level function and not directly addressed by the network description, although the network architecture should not prohibit it. These are just some of the non-goals as I see them. More should be added as we go along.

Now that the requirements have been reduced some, lets start to itemize some of the requirements.

a) Must provide automatic public and private message server functions.

This was discussed in the introduction as the primary purpose of the network.

b) Must provide access to existing bulletin board system with a minimum of overhead.

The resources of the KA6M-1 machine and others are too vast to be excluded from the network due to a complex protocol the host must handle.

c) Must be able to utilize reasonable forms of physical channel including, but not limited to:

1 - Current VHF/UHF radios BELL 202 modems and TNCs.
2 - Current HF radios with BELL 202 modems and TNCs.
3 - Voice grade satellites (Oscar-10 et al).
4 - Data grade satellites (PacSat et al).
5 - Phone lines.

d) Must be able to utilize several forms of nodes:

1 - Intelligent store and forward nodes.
(computer with mass storage)
2 - Relay only nodes.
(existing packet repeaters and voice satellites).
3 - Limited store and forward stations.
(PacSat and other physically unaccessable stations).
4 - Limited access nodes.
(only available certain times).

e) Must be implementable using current technology.

This means the average user should be able to access the network with an existing TNC (perhaps with a new set of ROM's). Network gateways and links should also be able to use existing TNC's with unspecified external modems.

f) Should provide ability to create entire network with current technology equipment.

There is no reason the east coast of the United States should not be linked on VHF/UHF to the west coast through uncounted TNCs running simple relay-only software in key locations. The network must not make any restrictions on the number of hops in a link.

g) Should provide automatic dynamic routing.

Static routing is fine when all nodes are known and paths are consistent. With satellites and dynamic propagation included in the network, static routing is not acceptable. The network should be able to take advantage of additional nodes as they become available if using them would increase throughput.

h) Should allow for prioritizing messages.

This goes without saying. It would be stupid to fill PacSat for one entire pass with the current CP/MUG volume and delay an emergency communication.

i) Must provide positive acknowledgment of message delivery.

With unreliable links, positive end to end acknowledgment is essential.

j) Must be defined in terms of a layered architecture.

1) Should conform to the ISO model.

2) Local area net and long-haul nets separate only at higher levels.

3) Architectural impressions isolated to higher layers.. E.G. Multihop is a level three function and should not impact level two operations.

k) Local area must be able to support such services as:

1) Point to point communications.

2) Round table nets.

3) Random access nets.

4) Priority break in on open connections. Ability to specify no-break for non-interuptable connections such as file transfer.

5) Multiple sessions for a given address. Computers with the ability should be able to use a TNC as a terminal concentrator with multiple sessions open on the device. Also used in round-table nets by net control.

Areas not addressed by this document and deferred to design concepts document include:

a) Virtual circuit vs datagram discussion.

b) Station addressing scheme. With dynamic routing it would be convenient if a station address contained a description of the location...implies hierarchial addressing.

c) User interaction command and syntax.

d) Message formats, file storage formats.

e) High level flow control, message rejection and retransmission.

f) Error recovery.

This completes the preliminary design requirements document. Until the requirements of the system are well defined and agreed upon, little productive work can take place.

References

[1] Tanenbaum, A.S.[1981]. "Computer Networks," Prentice-Hall, Englewood Cliffs, N.J.

[2] Magnuski, H.S.[1981]. "Local Area Network Design Issues, 2nd Edition" in Bulletins from the PACIFIC PACKET RADIO SOCIETY, pp 10-13.

TO: HM
FROM: PK
SENT: 11 JAN 84 09:46:25
READ: 13 JAN 84 00:43:38

At one of the PACSAT design reviews a while back, I remember making the joking comment that PACSAT will be the first AMSAT satellite in which we won't have to keep telling users to reduce their uplink power.

I'm now not so sure of this assertion, so I'd like to go through a little analysis to solicit comments. I'll discuss the whole issue of channel spacing assignments and demod filtering as it affects operating limits on uplink power and adjacent channel interference.

Since all of the uplink channels will share a common receiver front end, AGC (excepting a radar pulse blanker) should be kept out of the RF stages if at all possible. This is to keep the uplink requirements for any one channel independent, if at all possible, of the others. It is possible for a receiver front end to be driven by a signal so strong that there is no choice except for the gain to be reduced to keep later IF stages from limiting. However, I'll assume that this AGC threshold is set so high that in normal operation it won't be budged (unlike AO-10). Therefore, we'll assume a constant conversion gain between the antenna terminals and the demodulator bank inputs.

The components used in the demodulators all have pretty wide dynamic range. I suspect that the MF10 will be the limiting part (pun intended); while the data sheet doesn't give a noise spec, they do give a channel crosstalk level of -50 db. On the other hand, since the demodulator is basically a DC-coupled affair, I've run into a significant challenge! DC offsets. The MF-10 in particular has an offset of almost 200 millivolts on its low pass output when set up as a unity gain Q=1 filter, although the spec sheet claims that they are temperature and clock independent.

The double-balanced mixers have a typical offset of 2mv, which is amplified becaue the mixers have to operate at fairly low levels. The LM324 op amp (of which there are several on AO-10) has a worst case offset of +-7 mv. And so it goes. Theoretically these can all be nulled out with tweaks, but the thought of flying all those touchy pots and (somewhat) temperature sensitive components makes me nervous. There are some alternatives, such as very low frequency AC coupling between stages. With the bit stuffing present in HDLC, MOST data sequences end up with very small, if any DC component. However, someone could always send a pathological case, e.g., 11111001111100111111100...

I've just started looking at this problem, so I haven't evaluated all the possibilities yet. In any event, the net result will almost certainly be some limitation on the dynamic range which the demodulator can handle.

Channel-to-channel interference considerations will also limit the acceptable uplink signals. The demodulator output baseband filters (which are primarily responsible for controlling the selectivity of each channel) will consist of two cascaded switched capacitor low pass filters:

a) 1/2 MF10 confisured as a second order Butterworth with a 3db point equal to the Nyquist frequency of the channel (.5 * 10,000 bps = 5 khz, which becomes a double-sided RF bandpass of 10 khz). According to my simulations, this filter is a reasonably good approximation of a matched filter for my overlapped raised-cosine transmission pulses, coming to

within something like 0.6 db of the ideal. I found that to so much better than this you have to set much more complicated, and I decided it just wasn't worth it. This filter is therefore primarily responsible for setting the (white) noise bandwidth of the demodulator, and consequently the bit error rate in the absence of interference. Since this is a second order filter, the eventual high frequency attenuation slope is 12 db/octave.

b) 1 MF-4 4th order Butterworth with a 3db point set to twice the Nyquist frequency of the channel (10 khz baseband, 20 khz RF). This filter is responsible for attenuating adjacent channel interference, as it is too broad to have any significant effect on the white noise bandwidth. The phase response of this filter within the data channel itself is acceptable, since there is very little energy from the desired signal near the cutoff point of this filter where the group delay response starts to get nonlinear. This filter has a high frequency attenuation slope of 24 db/octave.

The transmitter envelope consists of overlapped raised-cosine (in time) pulses, most likely generated by a up/down counter, ROM look up table and D/A converter. As I've previously reported, this signal has some nice properties; it is fairly easy to generate and the peak-to-average power ratio is low (making it efficient to amplify). The spectrum within these limits is not flat, but is a good approximation to a rolled-off (cosine in frequency) channel with maximum energy density near the carrier and first spectral nulls at plus and minus 10 khz. The total RF energy outside these nulls is 33 db down, even without additional filtering (other than the reconstruction RC filter needed to smooth out the D/A steps). A 10 kilobit signal will occupy 20 khz between these nulls, which is the nominal channel bandwidth.

I wrote a program to compute the total QRM experienced by two channels operating at a given spacing. My assumptions were as follows:

1. Desired and interference signals are of the same strength.
2. There is only one adjacent channel (i.e., if you had a channel on each side of you, subtract 3 db from these numbers)
3. The data rate is 10 kilobits/sec, and the nominal RF bandwidth is 20 khz.
4. Both cascaded receive filters were included.
5. Non-ideal bandlimiting of the adjacent signal was considered (i.e, the -33 db out-of-channel "splatter").
6. The effects of anti-aliasing filters for the switched capacitor filters were NOT considered. Since the clock rates of the SC filters are fifty times higher than their -3db points, these filters can be very simple, and their contribution would be negligible.

Spacing (khz)	signal-to-interference ratio(db)
20	18.8
30	27.5
40	31.9
40	37.5

It turns out, interestingly enough, that interference is less damaging than white noise of the same power, and these numbers are well below the signal-to-white-noise ratios required for good bit error rates.

Note that the tightest spacing has NO guard bands at all; the upper spectral null of one channel coincides with the lower null of the next higher channel.

Now we have to consider the real world:

1. Doppler shift on 70cm in a low sun synchronous orbit is +-10 khz. Let's say the ground stations don't do doppler correction, and there are two different stations on adjacent channels, one at AOS and the other at LOS. This requires another 20 khz of guard band.

2. Add 10 khz to take the equal-power cross channel interference ratio down to 27.5 db. If you want to keep the interference ratio better than 15 db, this means that we can tolerate a directly adjacent channel signal that's up to 12.5 db stronger than the signal we want. Unfortunately, the difference in path loss between 500 km range (overhead) and 2600 km (horizon) is 14.32 db, so even if everybody runs exactly the same EIRP and there is no path fading (!) there would appear to be a possible shortfall. Fortunately, however, a station at minimum path loss will also be at zero doppler shift, so he won't simultaneously be at the edge of his doppler guard band. This buys us a few more db to take up the slack.

3. Throw in another 2 khz for crystal tolerances.

Bottom line:

Actual transmission bandwidth:	20 khz
Guard to increase adj channel rej:	10 khz
Doppler guard band:	20 khz
Misc tolerances (xtals, etc)	2 khz
	52 khz * 4 channels = 208 khz

The "bandwidth efficiency" is 38%, AND this assumes disciplined ground stations (in that their EIRPs are well matched.) Obviously we are giving up a lot of spectrum in order to simplify the ground stations.

To save 20 khz/channel, we need automatic doppler correction; to save 10 khz, we need automatic uplink power adjustment. Doppler correction could use either open-loop control with a computer tuning the transmitter, or could be closed-loop, using the Costas loop AFC voltages from the downlink receiver to proportionally steer the transmitter.

Uplink power adjustment could also be done open-loop by computer, or it could be a strategy which reduces power until a certain (small) percentage of retransmissions are required.

I'd like to get a discussion going on the relative merits of these options now that I've put the numbers out on the table. Comments?

73, Phil

TO: HM
FROM: MB
SENT: 06 JAN 84 06:56:53
READ: 06 JAN 84 20:39:18

Since everyone is talking about Level 3 lately, I thought this paper should be distributed (with Lynn's permission and persuasion) for your thoughts and comments. The comments may be directed to Lynn directly or thru me. (By the way this entire file was transfered to me via packet radio late one night). Mike

---

A Proposed Level 3 Routing Algorithm for Amateur Packet Radio

By Lynn W. Taylor, WB6UUT

Yea, from the table of my memory
I'll wipe away all trivial fond records.
-- Hamlet (Act I, Scene 5, line 98)

According to the ISO Open Systems Interconnect model, the network controllers are responsible for the first three of the seven protocol layers in a packet switched network. Layer 1, the Physical level, is responsible for the physical aspects of communication (radios, modems, HDLC, baud rates). Layer 2, the Data Link level, is responsible for taking the physical medium and making it error-free, and dividing it up among the users. The third layer, called the Network, or Communications Subnet level determines the host-subnet interface and how packets are routed in the subnet. Levels 4 through 7 deal with issues that are beyond the scope of this paper.

Routing is one of the key issues when defining a Communications Subnet Level protocol. The various routing algorithms can be divided into two categories, centralized (where some central station must know or discover the network topology, and serve as a clearinghouse for routing) and decentralized (where each TNC can handle at least part of the routing task). Centralized algorithms must be designed to recover when the master station crashes, and each station must know how to reach the router itself. Decentralized algorithms require each station to know how to pass traffic to other stations in the net; to accomplish this, the TNC needs to find out something about the nework topology.

I am going to discuss two specific routing algorithms, the advantages and drawbacks of each, and why I believe we should select a decentralized algorithm for Amateur use. None of this material is original, and most is discussed at some length in the computer science literature. Some of the combinations of this information are new, particularly as they relate to the specific problems of Amateur usage.

The first algorithm has a couple of advantages, and one major disadvantage. This algorithm does not require any special knowlege of the network topology, other than a list of stations that the TNC can hear. When the TNC receives a packet addressed to someone other than itself, it simply passes it on to everyone it can hear except the station it received it from. The

algorithm is appropriately called Flooding.

Flooding is easy to understand, and easy to implement. The problem comes when the load on the network increases. Since each packet will pass through every single node in the network, and many of them more than once, the amount of traffic generated by simply saying "Hi" can be staggering. Also, steps must be taken to prevent packets from looping forever through the network. The simplest case of this is a 4 station net (A, B, C and D) where all 4 stations can hear each other. If A originates a packet for D, it passes it to all 3 stations it can hear. B passes it to both C and D, where D accepts it, and C passes it to A and D. D has already got the packet and ignores the duplicate, while A passes it to B and D. Again, D discards it, and B passes it around. At the same time, packets are flowing in the opposite direction around the same loop. While this simple case could be easily fixed, it becomes more complex in a larger net. One solution is to limit the life of any given packet to a certain number of hops, but this still generates a lot of unnecessary traffic.

A better algorithm would require each TNC to have a table giving the address of each node in the network, some measure of the distance to that station, and the address of the next station along a path to that station. A hypothetical 5 station net, and each node's tables is shown below:

```
   A <---> B <---> C <---> D <---> E

 B 1 B    A 1 A    A 2 B    A 3 C    A 4 D
 C 2 B    C 1 C    B 1 B    B 2 C    B 3 D
 D 3 B    D 2 C    D 1 D    C 1 C    C 2 D
 E 4 B    E 3 C    E 2 D    E 1 E    D 1 D
```

In this example, the available communications paths are shown by arrows (i.e. A cannot communicate directly with C). Note that each station knows how far away all the other stations are, and who is the next station in the chain. If A wants to talk to D, A knows to pass traffic to B, and it will take 3 hops to get there. It is up to B to know who to pass these packets on to.

The problem with this method is easy to see -- where do these tables come from? In the proposed WestNet protocol, which defines a long-haul network for linking geographically seperated LANs, a similar algorithm is used which assumes all nodes internal to the network will stay on. In other words, this network is static (because all the nodes are dedicated devices to be installed on mountaintops). In a local network, stations (nodes) tend to appear and disappear frequently.

In a dynamic network, the answer to the question must be "from the network itself." This further divides into two problems: how does a new station get it's initial table, and how do we make sure the table each node has is up to date. To clarify this problem, lets add station F to our earlier network:

```
          A <---> B <---> C <---> D <---> E
          ^                               ^
          !                               !
          ---------------> F <-------------
```

In this example, A should now pass traffic for E through F, while traffic for D can follow it's previous route, or as efficiently through E and F. If all stations listen for new stations on the air, and F comes on and sends an "I'm here" (or CQ) packet, A and E can detect F's presence, connect with F to make sure they can communicate, and pass copies of their routing tables. By taking the best information from both tables, F can build it's initial table:

```
A 1 A
B 2 A
C 3 E
D 2 E
E 1 E
```

There are two equally good paths from F to C (through E and D, and through A and B), F selects these at random.

Also, the rest of the net need to be told about the new network topology. First, A (and simultaneously, E) tells everyone it can hear that F is one hop away from it. B checks it's routing tables, decides that this is good news, and passes the news along to everyone it can hear, etc. This is the flooding algorithm again, with a twist; stations only pass on good news, so if a station already has a path of length N, it only passes on news of a path of N-1. In other words, when B announces to A and C that "I'm 2 hops from F", C is glad to hear, while A could care less, since A is only 1 from F, while C didn't even know F existed. C will wind picking the first path to F it hears about, since it has 2 paths of length 3 to F. This also means that C might use a different path to F than F would use to C; this does not matter since each have the same length.

F would also pass on the news of it's complete routing table, since the whole table is news to it. This way, A learns of the new path through F to E and E learns about it's new paths. The new tables would look like this:

```
B 1 B   A 1 A   A 2 B   A 3 A   A 2 F
C 2 B   C 1 C   B 1 B   B 2 C   B 3 D
D 3 B   D 2 C   D 1 D   C 1 C   C 2 D
E 2 F   E 3 C   E 2 D   E 1 E   D 1 D
F 1 F   F 2 A   F 3 A   F 2 E   F 1 F
```


```
A 1 A
B 2 A
C 3 E
D 2 E
E 1 E
```

Adding a node to the network is easy compared to what happens when a node leaves the net. Having a node tell the net it's leaving is impractical, because that node may not be able to tell the net because of hardware failures, power failures, or propogation changes. One solution would be for a node to report

to the rest of the net that node X is unreachable whenever it can't pass traffic on to X. This bad news would be passed through the net until it reaches X, which would then tell those stations it can still reach that it is indeed still reachable, generating a new set of entries in the network tables.

As an example, A is passing traffic for E through F when F goes off the air. A, realizing that it can't pass traffic through F announces to B that E is unreachable. B passes this news to C, who passes on to D, and eventually to E. At this point, E has been erased from everyone's routing tables. E would then tell D "I'm still accessable", D reports to C that "E is still 1 hop from me", and the good news passes through the net (and contradicts any bad news still circulating). A may now use the longer path through B, C and D, and the network has recovered from the loss of the path to E through F.

The problem of updating the routing tables is the most serious drawback of this algorithm, and I am not suggesting that the method I have explained above is the best. In Computer Networks by Andrew Tannenbaum, he points out that "good news travels fast" while bad news may take awhile to propogate through the network, especially where looped paths exist. By completely eliminating a station from the network tables and re-inserting it, many of these kinds of problems may be avoided.

I have explained two decentralized routing algorithms. These algorithms allow the nodes themselves, on an equal basis, to decide how to route data in the net, and dynamically alter the routing when the network composition changes. What are the problems involved in a centralized algorithm?

Centralized algorithms require a single station to have complete knowlege of the network. To do this, the master station must probe the network, and pass on it's discoveries to the rest of the net. The master must either be a unique station type, or, in a homogeneous network, a station must be selected to be the master. A new station, when it comes on the air, must be able to tell the master it is on, and, if it can't reach a master, would most likely become one. Problems exist, in the case of two networks "growing" together (more than one master), and when the master fails. Depending on the implementation, a network may continue to operate without the master based on old information the master distributed, or collapse when the master disappears. Either solution would be undesirable.

I have shown that a properly designed decentralized system will not suffer unduly from the loss of any single critical station, and recover from the loss of any node in a reasonable manner. Centralized systems rely on the master station discovering the complete network topology, finding changes due to propogation, etc. and distributing this info. Since Amateur packet nets are very dynamic, it is probable that the master will be lost, causing the net to crash, or continue on without any direction.

While I feel the decentralized approach is best, the possibility of reasonable mechanisms for operating centralized networks, hybrid networks, rings, token passing schemes, and other are all worth investigating. My main purpose is to serve as a catalyst for further discussion.

1206F Vicente Drive
Sunnyvale, CA 94086

January 28, 1984

Hank,

Enclosed is a pair of article which I think will fire your imagination as they did mine. One describes a modem chip set that can run at up to 2Mbits/sec. The other concerns a new controller for token-passing LANs. It can operate at a comparable rate.

It seems to me that in general (not having done a detailed study of these parts), we would be able to incorporate them in an advanced packet radio board which might contain cpu, TNC, a good slug of memory, and a modem all on one STD bus board.

At any rate, keep the copies of the articles and look them over. I will collect more information on these chips as it becomes available.

Regards,

Chris Winter

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